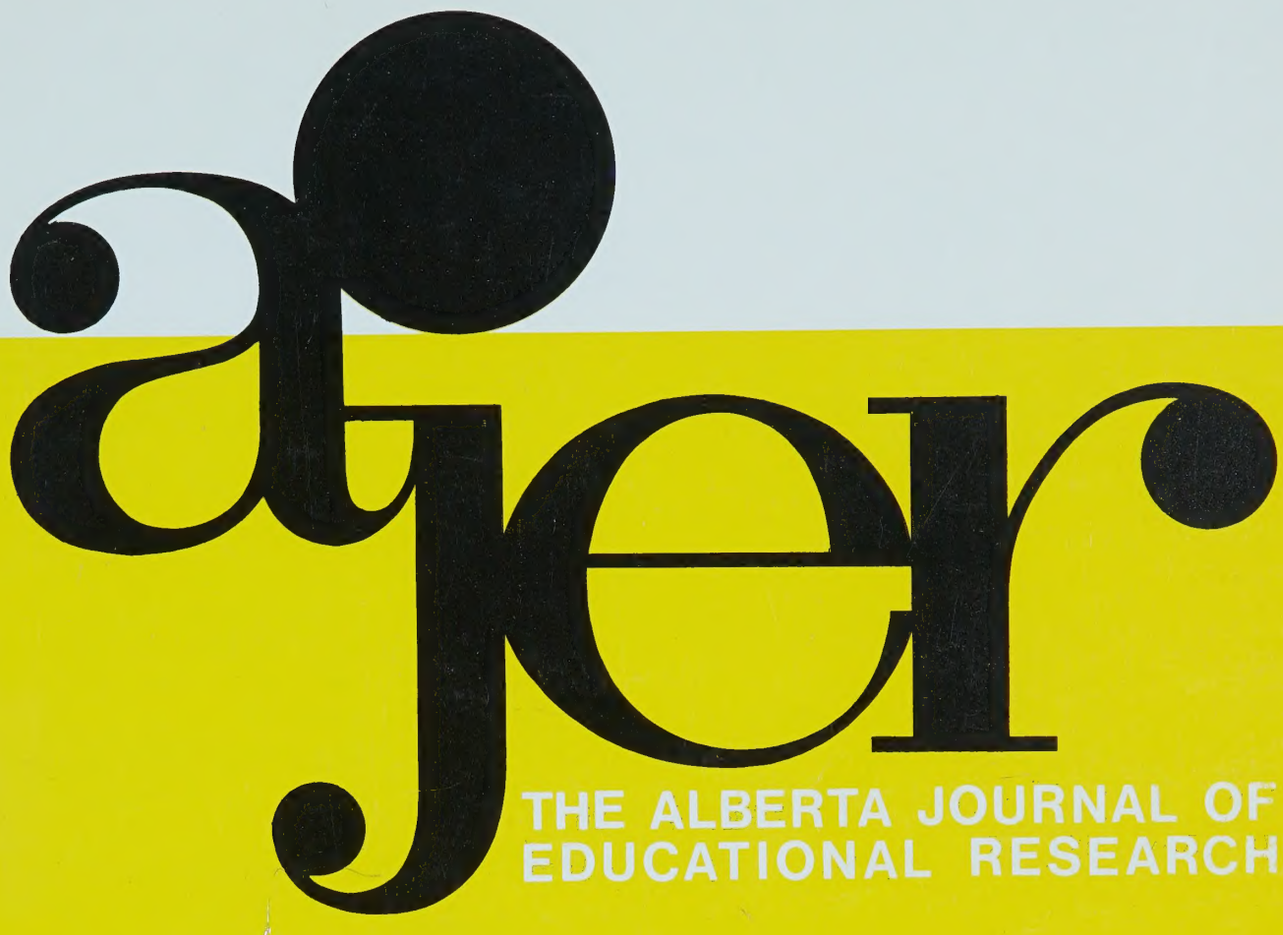


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# Achievement, Behavioral Correlates and Teachers' Perceptions of Francophone and Anglophone Immersion Students

*Comparisons between French and English achievement are drawn between francophone, anglophone and mixed subpopulations of students in French programs. Behavioral, cognitive, and academic correlates of language competence of the three subgroups are discussed. Correlations between English and French cloze performance and other intelligence and cognitive abilities were found to be high. Students who performed well on French cloze tests tended to perform well on English cloze tests as well. Differences between the mixed group and both the French and English groups are reported in terms of academic cooperation as well as teachers' perceptions of these subgroups.*

Fifteen years ago bilingual education programs were almost nonexistent in Canada. Today, programs which use both French and English as media of instruction are in operation in every Canadian province and major city. Nevertheless there have been few reports of comparisons between different

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populations across Canada. Furthermore, while recent attention has focused on anglophone children acquiring French in immersion classes, it is important to realize that in all provinces outside of Quebec, francophone children are also receiving instruction in French immersion. Although the aim of bilingual programs for both anglophone and francophone students is the same, i.e. to develop functional bilingual skills including literacy in both languages, the educational experience of these two subgroups can differ widely. For anglophone children outside of Quebec, French as a new schooling experience or second language (French L2) is promoted in the immersion experience. However, for francophone children outside Quebec, it is the mother tongue and/or *home language* (French L1) that must be strongly promoted by the school *and* the home in order to maintain and improve students' French skills. That is, because the influence of English is so strong and assimilation so rapid in North American contexts outside of Quebec, French, rather than English, is the language which needs to be promoted most strongly by the school for both anglophone *and* francophone children if they are to develop a high level of bilingualism. Nevertheless, streaming of classes between anglophone and francophone subgroups is often promoted for a variety of reasons including different learning histories in French acquisition and different levels of initial mastery of the French language. It may be argued that both reasons necessitate different French programs which are specifically designed for the strengths and weaknesses of the two subgroups.

A related issue is whether or not francophone children will advance more rapidly in exclusively francophone schools. The complexity of this latter question is compounded by the fact that one of the principal concerns for both francophone and anglophone parental groups is the children's *English* achievement. For many of the francophone parents who have recently arrived from Quebec or abroad, English is often recognized as the language of social mobility and a failure to acquire a high level of English skills, it is thought, may considerably reduce the child's scope of economic and educational success. Similarly, many anglophone parents presume that the school plays an important role in developing the child's English skills and the relative lack of emphasis on the use of English in immersion schools is often a source of concern to parents. These interdependent issues are relevant to the immersion program in primary schools operated by the Edmonton Catholic School System (ECSS) where instruction is in the medium of French for 80% of the school day throughout the elementary schools which are attended by children from both francophone and anglophone homes.

The present study sought to gather information on these related issues by posing several questions. First, how do francophone, anglophone and mixed francophone-anglophone subpopulations compare in their relative mastery of French comprehension during the latter part of elementary school? Second, how do these francophone students compare with francophone students in Quebec or francophone students in exclusively francophone schools in Ontario? Third, how do francophone, anglophone and mixed francophone-anglophone students in Edmonton compare in terms of their English comprehension and how do these groups compare with anglophone students enrolled in regular programs? Fourth, what are the indicator or predictor variables that are associated with superior performance in French immersion that might be utilized to predict whether a given student would or would not experience difficulties in an immersion program? To answer the last question, this study also was aimed at examining the correlation between school behavioral factors, mental abilities, and French and

English performance in order to determine if there were potentially useful predictor variables for predicting French and English comprehension for both francophone and anglophone subpopulations. Finally, a study was conducted of how teachers perceived the subpopulations of francophone, anglophone, and mixed francophone-anglophone students to determine if the teachers' perceptions corresponded with the predictor variables of performance levels. This part of the study was effected in order to gain information on how the three different subgroups were perceived by the teachers and also how the subgroups perceived themselves in order to study the correlations between teacher perception of the student, students' self-perception, and performance in French immersion programs.

## *Method*

### *Subjects*

All grade 5 students in three schools (Grandin, St. Thomas, and Our Lady of Lourdes) of the Edmonton Catholic School System (ECSS) were tested. An eight-item questionnaire was administered to the children regarding their preference and frequency of usage of languages with each of their parents, siblings, teachers and friends within the school, the home, and the community. Children were assigned to one of four groups on the basis of their responses to this questionnaire.

Group 1: *Francophone* — children who spoke French most of the time at home;

Group 2: *Mixed* — children who spoke both French and English at home or who reported that they spoke English and that their parents spoke French most of the time;

Group 3: *Anglophone* — children who spoke English most of the time at home and whose parents spoke English most of the time;

Group 4: *Other* — children who spoke a language other than French or English to one or both parents.

There were 26 children in the Francophone group, 30 in the Mixed group, 41 in the Anglophone group, and 7 in the Other group.

### *Instruments*

*French and English Cloze Tests.* In a cloze test, every *n*th word (in this particular case every 7th word) is deleted from a passage of prose and the students are asked to supply the missing words. Cloze tests have been previously used to evaluate the French and English performance of children in French immersion programs by Swain, Lapkin and Barik (1976) and by Lapkin and Swain (1977) in Eastern Canada; these tests have been found to provide both an efficient and comprehensive measure of language comprehension and production.

In order to allow comparisons to be made between the cloze performance of students in the immersion program in Edmonton and comparable children in Eastern Canada, we used cloze tests which had been developed by the Bilingual Education Project at the Ontario Institute for Studies in Education (Lapkin & Swain, 1977) because reliable data existed on cloze performance by comparable immersion students in Eastern Canada on these tests. These cloze tests for both English and French comprehension were of the following format:

The soup was very _____ and I cried because it burned _____ tongue.

The instructions and procedure were the same as in the Lapkin and Swain study. The "exact" rather than "acceptable" criterion for correct answers was adopted for reasons outlined by Swain, Lapkin and Barik (1976) and Lapkin and Swain (1977).

*Teacher's Rating Scale of Student Behavior.* The teacher's rating scales of student behavior were adopted from Genesee and Hamayan (1980) where they had been used to examine behavioral correlates of French achievement in immersion programs. This nine-item questionnaire included questions on students' usage of French in classrooms and hallways, the initiation of (and response to) questions and discussion, classroom participation, sociability, work habits, homework completion, and requests for additional work. The results from these rating scales were submitted to factor analysis.

*Students' Attitudes and Usage of French.* On the student questionnaire, students were asked which language(s) they used with parents and siblings (items 1-6). The remaining three items asked to what extent students were eager or happy to have the opportunity of using French outside the classroom and which language they preferred to use with their teacher and friends.

*Ability and Achievement Measures.* The Lorge-Thorndike Verbal, Non-Verbal and Full Scale IQ scores and the reading and vocabulary subtest scores from the Canadian Tests of Basic Skills were taken for the ESSS immersion students from their school records.

## *Results*

### *French and English Cloze Test Performance*

The mean French and English cloze test scores for the four groups in the ESSS bilingual schools and the four comparable groups from Eastern Canada from the Lapkin and Swain study are presented in Table 1. A typographical error on item 14 of the French test meant that this item could not be used in the analysis. Thus, the scores on both the French and English test are from a total of 30. With the aid of data presented by Lapkin and Swain, it was possible to eliminate item 14 and prorate the French means for the Eastern Canadian groups.

Two-tailed t-tests with Welch adjustment for unequal variance showed no significant ($p \leq .05$) differences between the ESSS groups on the English cloze test. However differences between the Francophone and Anglophone ESSS groups on the French cloze test were significant ($p \leq .03$). Although the scores of the ESSS Other group are lower than those of the remaining three groups, the differences are not significant (due to the very small number) and are assumedly accountable for by the lower mean IQ of this group.

The ESSS francophone group performed as well as the Franco-Ontarian group (who attended separate Francophone Schools) on the French cloze test but less well than the Quebec francophone group. These data are consistent with the hypothesis that francophone students who are schooled with anglophone students in an immersion experience appear to perform as well in French using these tests as a measure as do francophones who attend exclusively francophone programs in Ontario. On the other hand the performance of francophone students in Quebec is clearly superior to that of both other francophone groups, presumably due to the

quality and quantity of French usage outside the school. Such findings underline the necessity of considering the quality of French that students use within and beyond the school in order to compare exclusively francophone and combined francophone and anglophone immersion programs. Similarly, any research results that would deal with the thorny question of exclusively francophone or anglophone schools would require that the results be constrained to that particular milieu or setting.

TABLE 1
ENGLISH AND FRENCH CLOZE TEST PERFORMANCE
OF GROUPS IN WESTERN AND EASTERN CANADA

| | Mean French Cloze Score | Mean English Cloze Score | Mean Lorge-Thorndike Full-Scale |
|---|---|---|---|
| ESSS Francophone (*N*=26) | 16.3 | 19.5 | (110) |
| ESSS Mixed (*N*=30) | 14.4 | 20.7 | (107) |
| ESSS Anglophone (*N*=41) | 13.1 | 21.0 | (112) |
| ESSS Other (*N*=7) | 12.5 | 17.3 | (99) |
| Immersion (LS)*** (*N*=94*) | 15.3 | 21.2 | (113)** |
| Regular (LS) (*N*=53) | -- | 20.7 | |
| Franco-Ontarian (LS) (*N*=53) | 15.7 | -- | |
| Quebec Francophone (LS) (*N*=26) | 18.9 | -- | |

* The *N* for the English test was 91.

** Based on the sum of Canadian Cognitive Abilities Test scores (personal communication Sharon Lapkin).

*** LS from the Lapkin and Swain study.

The ESSS anglophone immersion group performed less well on the French cloze test than the Eastern anglophone immersion group, even though the groups are essentially identical in terms of IQ and English cloze test performance. This finding raises the unlikely question that anglophones may progress more rapidly in an exclusively anglophone immersion class than in a mixed francophone-anglophone immersion class. One of the many possible contributors to this difference is the fact that the eastern immersion group may have identified with the goals of the program more closely since the teacher could concentrate more on their particular needs.

In terms of English cloze test performance, there were no differences among the groups. These data indicate that the francophone, mixed and other groups perform as well on the English test as both the anglophone groups of students in three Edmonton schools and also as well as the regular anglophone classes and the

immersion students in Ontario on this test of English comprehension. These data are consistent with the idea that students can enroll in French immersion programs and their performance will be comparable in *English* comprehension with that of students enrolled in regular programs. As previously mentioned, however, such results, while informative in terms of comparing groups of students in diverse areas in Canada, do not imply control of the numerous variables which may be causally related to the outcome.

TABLE 2
CORRELATIONS BETWEEN ENGLISH AND FRENCH CLOZE TESTS AND OTHER VARIABLES FOR TOTAL GROUP ($N$=104)

| Variable | French Cloze | English Cloze |
|---|---|---|
| 1. French Cloze | 1.00 | .57* |
| 2. English Cloze | .57* | 1.00 |
| 3. Lorge-Thorndike Full | .65* | .58* |
| 4. Lorge-Thorndike Non-Verbal | .45* | .41* |
| 5. Lorge-Thorndike Verbal | .68* | .60* |
| 6. CTBS Reading | .61* | .66* |
| 7. CTBS Vocabulary | .55* | .76* |
| 8. Teacher Rating (TR) TR 1 Asks questions | .20* | .19 |
| 9. TR 2 Responds to questions | .27* | .18 |
| 10. TR 3 Group participation | .27* | .04 |
| 11. TR 4 Friends | .10 | .15 |
| 12. TR 5 Lively | .03 | .04 |
| 13. TR 6 French at recess | .13 | -.21* |
| 14. TR 7 Asks teacher's help | .10 | .17 |
| 15. TR 8 French in corridors | .08 | -.19 |
| 16. TR 9 Extra French at home | .47* | .17 |
| 17. Student Questionnaire (SQ) SQ 1 Language spoken by mother | .19 | -.12 |
| 18. SQ 2 Language spoken by father | .19 | -.06 |
| 19. SQ 3 Language spoken to mother | .18 | -.12 |
| 20. SQ 4 Language spoken to father | .09 | -.11 |
| 21. SQ 5 Language spoken to siblings | .19 | -.06 |
| 22. SQ 6 Happy to speak French | .19 | .11 |
| 23. SQ 7 Language preference to teacher | .17 | .11 |
| 24. SQ 8 Language preference to friends | .09 | -.09 |
| 25. Sex (1 = female, 2 = male) | -.26 | -.09 |

* $p \leq .05$ (Due to missing data some coefficients are computed on less than 104 cases)

*Correlates of French and English Cloze Performances*

The correlations between English and French cloze performance and the other intelligence and cognitive abilities tests as well as behavioral variables are presented in Table 2. As in the Lapkin and Swain study, the correlations between the French and English cloze tests and the other cognitive/achievement variables are highly significant. Thus, students who perform well on French cloze tests also perform well on English cloze tests, on all 3 tests of IQ, and on tests of cognitive abilities and reading abilities. Therefore, the student who performs well on these French tests is, typically, highly competent in English as well and tends to be above average on the measures of intelligence and cognitive abilities including reading. Performance on the French cloze test is also strongly correlated with teachers' perceptions of children's willingness to perform extra work in French (TR 9) and to a lesser extent to teachers' perceptions of student class participation and initiation of and response to questions (TR 1-3). Thus, teachers perceive the students who score well on these French cloze tests to be very interested in extra work in French, active in class participation, question posing and question answering. Those students who do not perform well in English are perceived to be students who frequently use French at recess (TR 6). This relationship presumably indicates that it is mainly those children who feel less comfortable in English who use French at recess in these schools and that all other groups primarily use English at recess.

*Group Differences on Behavioral and Attitudinal Indices*

Differences between francophone, mixed, and anglophone groups on the Teacher Ratings and Student Attitudinal variables (SQ 6-8) are presented in Table 3. All significant ($p<.05$) differences (marked with *) are based on two-tailed T tests with Welch adjustment for unequal variance. The convention F > M is used to indicate that children in the Francophone group were rated higher or more favourably than the Mixed group on the particular dimension.

The most striking differences are those between the French and Mixed groups. Teachers rate the French group as more cooperative academically (TR 1, 3, 7, 9; TR 2 approaches significance, $p<.06$), and more likely to use French at recess (TR 8). There are also large differences between these two groups in the extent to which they report usage of French with friends outside the school.

The French group are rated higher by their teachers (TR 6, 8) and rate themselves higher (SQ 8) than the English group in the extent to which they use French outside the classroom. The English group are rated higher than the Mixed group on two indices of academic cooperation (TR 7, 9).

The differences between the Mixed group and both French and English groups in terms of academic cooperation suggest that some individuals within the Mixed group may have ambivalent or negative feelings in relation to their usage of French and their attendance at French-medium schools. There are no differences between the groups in either IQ or English academic achievement (CTBS and cloze tests), thus the differences noted by the teachers seem likely to be specific to the children's attitude towards French. Although the Mixed group in the present study is not a homogenous group, approximately one-third of the children reported that both parents spoke French most of the time to them but that they spoke English most of the time to their parents. This pattern shows the strength of the assimilation process and suggests that the relative lack of academic

cooperation among some members of the Mixed group as perceived by their teachers may be related to conflict between francophone and anglophone roles and identities and, hence, the status of French as a language of communication.

TABLE 3
GROUP DIFFERENCES ON BEHAVIORAL AND ATTITUDINAL INDICES

| Variable | F>M | F>E | E>M |
|---|---|---|---|
| TR 1 | * | | |
| TR 2 | | | |
| TR 3 | ** | | |
| TR 4 | | | |
| TR 5 | | | |
| TR 6 | * | ** | |
| TR 7 | * | | * |
| TR 8 | | ** | |
| TR 9 | ** | | * |
| SQ 6 | | | |
| SQ 7 | | | |
| SQ 8 | ** | ** | |

* $p<.05$
** $p<.01$

*Conclusions*

On the French cloze tests the Edmonton francophone group performed better than the anglophone and mixed francophone-anglophone group and just as well as the comparable francophone group that was schooled in an exclusively francophone school in Ontario. These data do not corroborate the view that francophone students would necessarily advance more rapidly in an exclusively francophone school. However, the expected superior French cloze performance of francophones in Quebec does indicate the importance of the quality and quantity of French spoken both within and outside the school. On the other hand, the finding that ESSS anglophone students enrolled with francophone students performed less well than anglophone students enrolled with an anglophone only immersion program in Ontario in spite of the fact that their I.Q. and English cloze test peformance was essentially identical, does lend credence to the value of separate programs for anglophone and francophone students. However, while such a possibility is intriguing, far more research would be required to legitimize such comparisons across schools. Any future research concerning the question of separate francophone and anglophone schools must address the question of the quality of the French that is spoken in the school, the family and the social

milieu. Moreover the high correlation between performance on the English cloze test and French cloze test indicates that those students who perform well in French also perform well in English and vice versa. While there may be some facilitating interaction of the two languages as consistent with the threshold hypothesis, these results are more plausibly interpreted as due to the strong cognitive component in language learning as indicated by the strong correlation with all IQ and cognitive ability tests.

However, it does not follow that only students with high cognitive abilities should enroll in immersion programs. On the contrary the controlled comparison between the Edmonton anglophone, francophone, and mixed immersion class and the regular Ontario anglophone class indicates that French was being acquired at no expense to their English skills as measured by these tests.

On the other hand, there was evidence that children from mixed home background are perceived less favorably by teachers in terms of their classroom participation and academic cooperation. In addition, these students showed a strong tendency to address their parents in English although their parents addressed them in French. Further research would be needed to elucidate the causal relation between the teachers' perception of the lack of academic cooperation of this group and their attitudes towards speaking French. In particular the teachers' perception of the mixed group to be less involved than the French group in: group participation (TR 3), asking questions (TR 1), asking for help (TR 7), and asking for extra French at home, than both the French and English subgroups may reflect the lowered status that speaking French has for these individuals as opposed to both the French *and* English subgroups. This is suggestive that the mixed group of students are perceived as less academically cooperative than both anglophone and francophone groups and either perceive themselves as belonging to neither of the principal student groups and/or identify less with the French language goals of the school.

Further research should involve an examination of how these subgroups perceive the status, importance, and utility of acquiring competence in French or how they perceive the learning environment. Presumably such information would have implications both for teachers' accurate perceptions of these different subgroups and consequently for their sensitivity and interaction with members of these different subgroups. Such data may well underline the importance of investigating attitudinal variables and their implication for the modification of teaching methodologies to promote appropriate attitudes in language learning situations. Such methodologies may include the infusion of culture components to enhance the status and communicative value and hence, students' attitude towards language acquisition.

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# Determinants of Teacher Professionalism

*In search of critical factors affecting teachers' attitudinal professionalism, variables at personal, school, and district/division levels were scrutinized and compared. One thousand two hundred and five teachers, about one-tenth of the teaching force in the province of Manitoba, Canada, from 120 elementary and secondary schools in metropolitan, small urban, and rural settings took part in the study. Analyses revealed the ascendance of district/division factors such as enrolment decline, teacher lay-off rate, perceived board-teacher relationship, feeling toward collective bargaining in shaping teachers' career attitudes, while personal factors faded into relative insignificance. On the other hand, the most single important factor affecting teachers' mentality still resided in their immediate working environment as peer relationship measured by group characteristics in school, affected profoundly from four out of five dimensions of professional attitudes. In view of the close association between peer norm and leadership style of the principals, it would seem to be of utmost importance for school administrators to develop appropriate intervention strategies to ensure an amiable and productive atmosphere to counterbalance adverse forces currently confronting public education.*

For the past two decades, there has been an unmistakable upsurge of activism sponsored by teacher oganizations aimed at gaining legal and social recognition of teaching as a profession. Militancy, identified as a natural outcome of the professionalization process (Corwin, 1965), manifests itself in demands for broadening the areas of negotiation, for greater participation in the decision-making process at all levels, and in strikes. On the other hand, strong resistance against such movement has come from vested interest groups both within and without the educational system. Understandably, the recognition of teaching as a profession would bring a fundamental change to the existing

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governance structure of education. Implicitly and explicitly, professionalization which demands the control of membership in the occupation, the licensing of teachers, the development and adherence to an ethical code, and the specification of working conditions would shift monitoring power from the provincial department or ministry of education and the local school board to the teacher organization. Given the magnitude of such a change and inherent opposition, it is doubtful that teachers will acquire full-fledged professional status in the near future.

Notwithstanding the formidable barriers, literature continues to debate the fundamental issue of whether or not teachers are truly professional. Two major problems, however, complicate this attempt at conceptual clarification. The first is the prevailing confusion between two aspects of professionalization, structural and attitudinal, as distinguished by Vollman and Mills (1966). While revamping the governance structure to achieve the structural aspect of professionalization is not going to materialize overnight, one should not hastily dismiss teachers as not truly professional. Indeed, it is the attitudinal dimension of professionalism, having profound effects on program delivery and the quality of instruction, that should constitute our major assessment criterion. The second problem is the way assessment of a vocation is achieved. By taking a snapshot of an occupation in the process of change and matching it against an ideal set of professional characteristics (e.g., Becker, 1963; Eisenstein, 1972; McDaniel, 1979), it is too tempting to reach a premature and inaccurate conclusion that either a vocation *is* or *is not* a profession. A more dynamic perspective encourages basing our judgment on the degree of professionalism a vocation displays, since all vocations can be placed on a continuum of professionalism during periods of rapid change.

*Theoretical Framework*

By refocusing professionalism on the attitudinal dimension, the seminal work of Richard Hall (1967), encompassing the following five aspects:

1. use of professional organization as a major referent;
2. belief in public service;
3. belief in self-regulation;
4. sense of calling to the Field; and
5. autonomy,

becomes the conceptual basis for the present assessment of teacher professionalism. Snizek's verification (1972) of 25 of the original 50 items that provide the best empirical fit constitutes a major component of such measures. In view of the present turbulent environment of the educational system, it is conceivable from a contingency perspective that the attitudinal dimension of professionalism registers both the degree of stress on the job and level of endurance teachers display. Thus a comprehensive study of teacher professionalism necessitates an inclusion and analysis of factors extracted from personal, school, and division levels.

At the personal level, attributes often cited as critical factors of attitudinal differences were sex (Hearn, 1971; Prather, 1971; Selinger & Goldhammer, 1972; Nastrom & Butler, 1975), teaching experiences (e.g., Lauglo, 1975; Lam, 1975), level of formal education (e.g., Bullough, 1970; Pavalko, 1970; Cortis, 1973), and professional development (e.g., Lam, 1982). In brief, sex was found to explain relative tolerance to the school bureaucratic system and the degree of militancy

displayed. Teaching experiences accounted for the degree of pedagogical commitment as well as relative assertion of professional autonomy. Level of formal education upheld "professional images" and promoted task devotion. Professional development tended to foster professional attitudes.

At the school level, three factors have been commonly cited to be related to the professional attitude of teachers. First was the grade level for which a teacher was responsible. Sharp contrasts were drawn between elementary and secondary school teachers in terms of perceptions, attitudes and satisfaction (e.g., Talmange & Orstein, 1973; Cortis, 1973). While recent findings do not dispute the significant impact this factor has on different attitudinal aspects of professionalism (Lam, 1982), it remains to be seen how crucial it is compared with other factors.

The second single factor at the local school level was colleague relationship. Recognizing that interaction between colleagues can become a valuable source for maintaining high levels of professional teaching, Doyle (1975) lamented that physical separation of the classroom and autonomy in teaching rendered teaching a private affair. In studying colleague reaction and teacher performances, Doyle and Olszewski (1976) further showed that open settings increased the commonality of behavior among teachers. Seidman (1975) singled out teachers' behavior as a critical factor contributing to climate outcomes.

A third factor at the school level associated with teachers' professional attitude is principals' leadership style. In view of the crucial supportive and supervisory role principals play, their leadership style is usually linked with teachers' perception of the school bureaucratic structure. There is no lack of research (e.g., Husarik & Wynkoop, 1974; Marjoribanks, 1977; Fraser, 1979) which stresses a need for principals to provide greater autonomy and to support and facilitate leader professional growth.

Much has also been reported about the impact on teachers' professional attitudes of the combined effects of collegial relationships and principals' leadership behaviors which constitute the organizational climate of the school (see Halpin & Croft, OCDQ, 1966). Coughlan (1971) for instance, reported that teachers working in a closed system did not feel that they had the same opportunity for upward advancement as did teachers in an open system. Null (1971) confirmed that certain attitudinal and personality variables of teachers were related to their perception of the behavior of their principal and fellow teachers and that teachers in an open climate tended to have a good attitude toward children.

At the district level, external factors representing major changes conceivably exert a profound influence on the professional attitude of teachers, though the empirical evidence is still scanty. One can speculate that declining enrolment and teacher lay-off might reduce the perceived importance of teachers' service to a community, hamper efforts at self-regulation, cast doubt on the sense of calling, restress the need for autonomy against bureaucratic control and promote greater adherence to the professional organization as a defensive mechanism against other political pressure.

As a response to the declining enrolment and teacher lay-off, teachers are likely to resort to a tougher stand in board-teacher negotiations. Literature widely documents that frustration of teachers has been transformed into demands for greater control of the policy-formulation process (Hennessy, 1975, 1977) which leads directly to challenges of school boards' jurisdiction and their operational

flexibilities (Glime, 1971; Young, 1971; Fay, 1976; Mankin, 1977; Newby, 1977). A recent empirical investigation in Manitoba (Lam & Kong, 1981) further confirmed the adverse effects of the present style of negotiation upon teacher-board relationships.

Arising from this body of literature and conjecture, enrolment decline and teacher lay-off, both actual and perceived, together with perceived board-teacher relationship and satisfaction with collective bargaining were viewed as relevant variables in accounting for teachers' attitudinal professionalism.

In addition, taking into consideration the growing realization of the profound extra-organizational influence on organization members' behavior and attitude (Griffiths, 1979) and the emergent contingency perspective (Hanson, 1979) which place increasing weight of population density, socioeconomic status and amount of community involvement on an organization's life, the effect of size and nature of the school setting upon teacher job attitude is interesting to explore. In particular it is anticipated that life-styles of the teaching profession in rural and urban settings are somewhat different and these together with the presence or absence of social and economic amenities in the communities would significantly affect teacher career attitude (Lam, 1982).

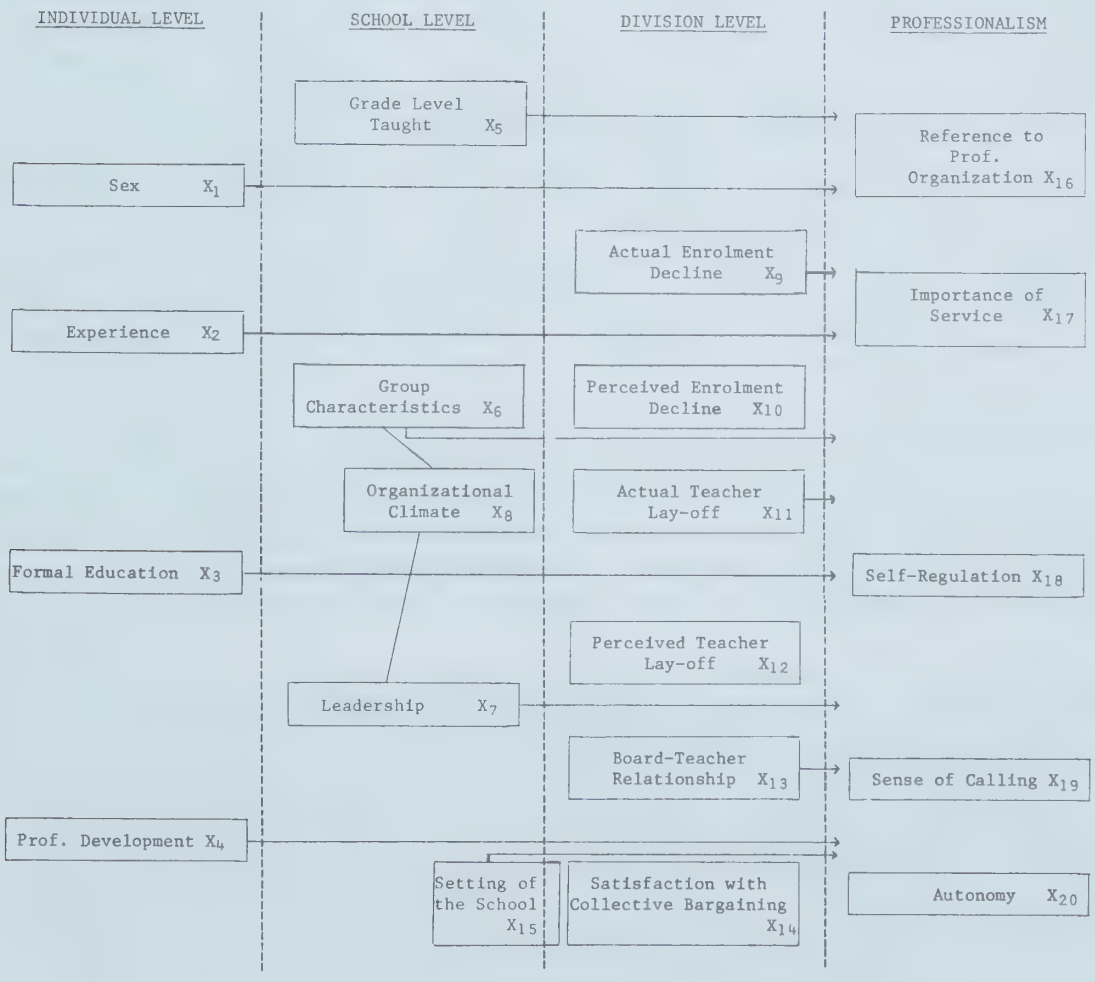


Figure 1. Schema for the teacher professionalism study.

In sum, constituting a paradigm addressed to the general question of what accounts for the attitudinal professionalism of teachers are three levels of factors considered to be of parallel importance. In the absence of literature on inter-relationships among these variables, no prediction of specific causal linkage was made (Fig. 1).

Understanding the degree of teacher attitudinal professionalism is of utmost importance to all concerned with the public education system when it is beset with growing problems. Where the professional attitudes deteriorate, it would be difficult to see how the quality of education demanded by the public could be ensured.

## *Methodology*

### *Sample*

To reflect provincial distribution of school districts and divisions in Manitoba, two school divisions from metropolitan areas, two from small urban and six from remote rural settings (representative of the ratio of number of divisions and districts in respective categories) were selected and approached for participation in the study. In total, 150 schools and 2300 teachers were included. About 1205 teachers from 120 schools in seven divisions and districts returned useful data for analysis. It is difficult to pinpoint causes for non-participation. One can only postulate sensitivity of the topic and substantial demands on teachers' time in providing data as plausible reasons. In view of the fact that participants represent one-tenth of the total teacher population in Manitoba, one can safely conclude that the present sample is big enough to warrant generalization of findings without jeopardizing external validity.

Testing of the paradigm developed in the earlier section necessitated that units of analysis be based on individuals, as the importance of personal factors could be assessed (on equal footing) with in-school and district factors.

### *Procedure and Design*

Contact was made with each of the superintendents of the sampled districts and divisions. Upon approval of the school boards, all principals in each district were visited and briefed on the nature of the study. They were then asked to designate staff members to look after the distribution and collection of questionnaires anonymously. These were then sealed and returned to the researcher.

Each teacher was asked to respond to a questionnaire consisting of four parts. Part I dealt with personal and general background factors. Part II was used to examine the organizational climate of the school. The abbreviated format was adopted, ranking the eight subscales of Disengagement, Hindrance, Esprit, Intimacy, Aloofness, Production Emphasis, Thrust, and Consideration in terms of "High," "Average," "Low," as described by Hall (1972). Part III was designed to discover the issues in teachers' respective divisions, such as their perceived Board-Teacher relationships, satisfaction with collective bargaining, their relative concern with enrolment decline and teacher lay-off rates. Part IV contained Snizek's revised version of Hall's professionalism scale. Each of the 25 items in the revised version was accompanied by a five-point Likert scale ranging from the category of "Strongly Disagree" to that of "Strongly Agree."

Additional data concerning the enrolment and the number of teachers employed by the sampled division in the past five years were gathered from the Division (district) Offices. Index of average enrolment decline for each district was derived by summing the year to year difference in student population divided by the number of academic years involved. Teacher lay-off index was similarly developed by assessing the annual difference in number of teachers employed and average sum total of difference.

### *Analysis and Discussion*

Prior to the assessment of the relative impacts of personal attributes, school and district factors upon various attitudinal dimensions of teacher professionalism, inter-relationships among all these factors had been analyzed (Table 1). Sex was found to be positively related to the actual teacher lay-off rate ($r=.93$). However, this latter factor was found to be related to the perceived teacher lay-off ($r=-.36$). Strong relationships also existed between group characteristics ($X_6$) and leadership style ($X_7$) displayed by the school administrators ($r=.48$). Further, both group characteristics and school organizational climates were closely linked with the perceived board-teacher relationships ($r_s=.61$ and .52 respectively). In another aspect, teacher experience ($X_2$) and professional development ($X_4$) were associated with grade level taught ($r_s=.31$ and .30) whereas setting was positively related to formal education and negatively related to perceived teacher lay-off rate ($r_s=.27$ and -.26).

What emerged, most interestingly, from this preliminary correlational analysis was that male teachers were related to the actual teacher lay-off. However, it was the female teachers who felt the "pinch" from the retrenchment, an error of perception confirmed by the negative correlation between the actual and perceived enrolment decline indices. A second interesting feature is that group characteristics and the overall school climate seemed to be associated with the perceived Board-teacher relationship, suggesting a growing intimate relationship between the internal and external working conditions for teachers.

Two other observations from the analyses should also be mentioned: one confirmed the common conviction that more teaching experience and greater benefits derived from professional development encouraged teachers to instruct higher grades; the other contradicted the belief that rural teachers were less well prepared compared with urban teachers when formal education and training were considered. All of these should substantiate the interpretation of subsequent analyses.

To the basic question as to what factors contributed most to each of the five aspects of professional attitudes, five stepwise regression analyses were performed (Table 2). In terms of the first dimension of attitudinal professionalism, namely "using of Professional Organization as a major referent," perceived teacher lay-off rate seemed to be the most important contributing factor, followed by grade level taught, board-teacher relationship and perceived usefulness of professional development.

With reference to the second dimension of attitudinal professionalism, "belief in public services," group characteristics of the teaching staff in school, and felt satisfaction with collective bargaining were found to be significant.

TABLE 1
ZERO-ORDER CORRELATION MATRIX OF VARIABLES
AND DIMENSIONS OF TEACHER PROFESSIONALISM

| Variables | $\bar{x}$ | S.D. | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ | $X_{10}$ | $X_{11}$ | $X_{12}$ | $X_{13}$ | $X_{14}$ | $X_{15}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Individual Level | | | | | | | | | | | | | | | | | |
| Sex ($X_1$) | .42 | .45 | | | | | | | | | | | | | | | |
| Teaching Exp. ($X_2$) | 15.71 | 17.99 | .02 | | | | | | | | | | | | | | |
| Formal Ed. ($X_3$) | 4.33 | 2.81 | -.01 | .02 | | | | | | | | | | | | | |
| Prof. Dev. ($X_4$) | 4.16 | 1.32 | -.03 | .16 | .06 | | | | | | | | | | | | |
| School Level | | | | | | | | | | | | | | | | | |
| Grade Level Taught ($X_5$) | 4.85 | 5.21 | -.02 | .31** | .01 | .30** | | | | | | | | | | | |
| Group Char. ($X_6$) | 2.60 | .50 | .10 | -.07 | .04 | .03 | -.06 | | | | | | | | | | |
| Leadership ($X_7$) | 2.19 | .43 | .05 | .00 | -.01 | .03 | .00 | .48** | | | | | | | | | |
| Org. Climate ($X_8$) | 2.54 | .65 | .07 | .03 | -.01 | -.07 | -.06 | .40** | .58** | | | | | | | | |
| District/Division Level | | | | | | | | | | | | | | | | | |
| Actual Enrolment Decline ($X_9$) | .03 | 1.15 | -.19 | .00 | .00 | -.02 | .25** | -.03 | .02 | -.06 | | | | | | | |
| Perceived Enrolment Decline ($X_{10}$) | 2.94 | 1.14 | .01 | .05 | .00 | .03 | .04 | .02 | .00 | -.07 | .00 | | | | | | |
| Actual Teacher Lay-off ($X_{11}$) | 4.04 | 3.32 | .93** | .02 | -.01 | -.02 | .00 | .07 | .05 | .05 | .00 | .02 | | | | | |
| Perceived Teacher Lay-off ($X_{12}$) | 3.42 | 1.22 | -.36** | -.02 | .02 | .05 | -.03 | .04 | -.05 | .01 | .04 | .06 | .23* | | | | |
| Board-Teacher Relationship ($X_{13}$) | 4.23 | 1.85 | .13 | -.03 | .03 | -.03 | -.02 | .61** | .15 | .52** | .01 | .07 | .11 | .07 | | | |
| Satisfaction with Coll. Bargaining ($X_{14}$) | 2.27 | 1.16 | -.05 | .09 | .00 | .13 | .09 | .13 | .04 | .03 | .00 | .63** | -.06 | .25** | .00 | | |
| Settings ($X_{15}$) | 1.59 | 1.19 | .08 | .00 | .27** | -.11 | .01 | .11 | .04 | .08 | -.01 | -.26** | .16 | -.16 | .09 | .00 | |
| Dimension of Teacher Professionalism | | | | | | | | | | | | | | | | | |
| I. ($X_{16}$) | 2.94 | .45 | -.16 | .00 | .00 | -.06 | -.10 | .06 | -.04 | -.06 | .03 | .00 | -.10 | .34** | -.06 | .00 | -.14 |
| II. ($X_{17}$) | 3.08 | .63 | .05 | -.03 | .01 | .00 | -.04 | .23* | .06 | .07 | -.02 | .07 | .10 | -.02 | .11 | .13 | .07 |
| III. ($X_{18}$) | 3.34 | .53 | -.01 | .00 | -.04 | .00 | -.02 | .20* | -.03 | -.02 | -.04 | -.07 | -.08 | .00 | -.04 | -.03 | .00 |
| IV. ($X_{19}$) | 2.19 | .64 | -.01 | .04 | .00 | -.06 | -.06 | -.11 | -.03 | .01 | -.08 | -.10 | -.01 | .02 | -.11 | -.10 | -.02 |
| V. ($X_{20}$) | 3.17 | .66 | -.01 | -.05 | .00 | .01 | -.08 | .21* | .10 | .07 | .05 | .12 | -.01 | .04 | .14 | .09 | -.03 |

*$p$ < .05 and > .01
**$p$ < .01 or better

TABLE 2
STEPWISE REGRESSION ANALYSES OF SIGNIFICANT FACTORS AFFECTING DIMENSIONS OF TEACHER PROFESSIONALISM

| Significant Predictions | B | R | $R^2$ | $df_1$ | $df_2$ | *F* |
|---|---|---|---|---|---|---|
| I. Using of Prof. Org. as a Major Referent | | | | | | |
| Perceived Teacher Lay-off Rate ($X_{15}$) | .32 | .33 | .11 | 1 | 1202 | 152.60** |
| Grade Level Taught ($X_5$) | .17 | .35 | .12 | 2 | 1201 | 12.54** |
| Board-Teacher Relationship ($X_{12}$) | -.17 | -.36 | .13 | 3 | 1200 | 7.14** |
| Usefulness of Prof. Development ($X_8$) | -.16 | -.37 | .14 | 4 | 1199 | 4.83* |
| II. Belief in Public Services | | | | | | |
| Group Characteristics ($X_9$) | .22 | .23 | .05 | 1 | 1202 | 22.28** |
| Satisfaction w/Collective Bargaining ($X$ ) | .20 | .27 | .07 | 2 | 1201 | 15.60** |
| III. Belief in Self-regulation | | | | | | |
| Group Characteristics ($X_9$) | -.17 | .20 | .04 | 1 | 1202 | 7.47** |
| Perceived Enrolment Conditions ($X_{12}$) | -.14 | .27 | .07 | 2 | 1201 | 4.27* |
| IV. Sense of Calling to the Field | | | | | | |
| Group Characteristics ($X_9$) | .18 | .11 | .01 | 1 | 1202 | 16.86** |
| Enrolment Decline Index ($X_2$) | .17 | .14 | .02 | 2 | 1201 | 9.29** |
| Satisfaction w/ Collective Bargaining ($X_{13}$) | .17 | .17 | .02 | 3 | 1200 | 9.31** |
| Perceived Enrolment Situation ($X_{14}$) | .16 | .18 | .03 | 4 | 1199 | 5.53** |
| Teacher-Board Relationship ($X_{12}$) | .18 | .19 | .03 | 5 | 1198 | 4.14* |
| Org. Climate ($X_{11}$) | .18 | .20 | .04 | 6 | 1197 | 7.82** |
| V. Autonomy | | | | | | |
| Group Characteristics ($X_9$) | .18 | .21 | .04 | 1 | 1202 | 57.94** |
| Perceived Enrolment Situation ($X_{14}$) | -.20 | .23 | .05 | 2 | 1201 | 11.42** |
| Grade Level Taught ($X_5$) | .16 | .24 | .06 | 3 | 1200 | 7.05** |
| Enrolment Decline Index ($X_2$) | .18 | .25 | .06 | 4 | 1199 | 8.02** |
| Satisfaction w/Collective Bargaining ($X_{13}$) | .19 | .26 | .07 | 5 | 1198 | .433* |

* sig. at .05
** sig. at .01 or better

In examining the third aspect of attitudinal professionalism, "belief in self regulation," group characteristics and perceived enrolment conditions were important factors.

With respect to the "sense of calling to the field," the fourth dimension of attitudinal professionalism, it was found, in descending order of importance, that group characteristics of teaching staff, actual enrolment decline in the past five years, satisfaction with collective bargaining, perceived seriousness of enrolment decline, perceived teacher-board relationship and the overall school organization climate were key factors.

In scrutinizing the fifth and last aspect of attitudinal professionalism, "autonomy," group characteristics was once again the predominant contributing factor, followed by perceived enrolment decline, grade level taught, the actual enrolment decline and lastly, the satisfaction with collective bargaining.

One can postulate, from the findings, that in a time of declining enrolment, the need for job security serves as a significant motivating force in rallying teachers under their professional organization. Secondary school teachers apparently experiencing higher lay-off rates were more attached to the professional organization than their elementary counterparts. Similarly, those who perceived greater benefit in professional development also felt more inclined toward their own organization as many inservice activities were sponsored by local and provincial teacher associations.

The belief in the importance of teaching service to the community traces its causal sources to group characteristics of the teaching staff and satisfaction derived from collective bargaining. Apparently, peer relationships in schools affected teachers' perception of how amiable their working environment was, and experience from collective bargaining affected their perception of how their services had been valued by the public. The combined effects of these internal and external factors seemed then to determine teachers' own appraisal of the relative importance of their services.

The conviction of self-regulation or ongoing professional upgrading seemed to depend on group characteristics of their peers in school as well as the perceived enrolment decline. Presumably, where the teaching staff were not in harmonious relationship in school and the lay-off possibility was keenly felt, the desire for further study and professional growth would be severely hampered.

To the extent that group characteristics, organizational climate of the school, enrolment decline, perceived Board-teacher relationship, and satisfaction with collective bargaining, all affected "Sense of the calling to the field," it seemed evident that morale and career devotion were hinged to the intricate balance of favourable and adverse conditions both within and without the school.

In view of the strong causal relationship between group characteristics of the teaching staff and autonomy of teaching, one can suggest that mutual support was crucial to the freedom teachers felt they had in course delivery. Other autonomy-relevant in-school factors such as grade level taught reaffirmed earlier analysis that secondary teachers were more ready to exercise discretion than their elementary counterparts. Furthermore, because external factors such as enrolment decline, both actual and perceived, and the degree of satisfaction with collective bargaining all had considerable impact on autonomy, one can speculate that job security, real or imagined, and amiable experience in negotiation allows teachers a wider latitude in carrying out their teaching responsibilities.

Overall, data generated from the study point to the need for considerable refinement of the model initially conceived to account for the five aspects of teacher professionalism. While individual factors display interesting relationship patterns with factors at other levels, none has any important direct impact upon teacher professionalism. The relative insignificance of this group of factors seems to highlight a changing context of the teaching profession which accounts for the present findings being inconsistent with earlier studies. As well, one notes the emergence of external school factors assuming a more vital role in shaping teacher professionalism. Implicitly and explicitly the relative shift in importance reflects a growing uniformity in teachers' backgrounds both in terms of formal education and professional development. At the same time, teachers' career mentality is increasingly to be understood by what is going on in the more global situations. In view of growing politicization engulfing the educational enterprise, the preliminary findings from this study should stir further investigations in this crucial area.

The contribution of school factors to teacher professionalism is on the whole moderate. However, group characteristics of the teaching staff stands out as the single most important factor for shaping various aspects of professional attitudes, denoting a continued importance of the immediate working environment, i.e., peers' social norm, in shaping teachers' career mentality and outlooks.

To the extent that school administrators' leadership style has close association with such social norms, administrators are placed in a critical position in balancing the on-the-job professional growth of their teachers against adverse global situations in the public school system. The search for an appropriate leadership style to decrease teachers' tendency towards disengagement from school activities and felt hindrance to doing their job, to bolster teachers' professional commitment, and to increase social intimacy becomes a primary challenge to school administrators in the eighties.

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# A Comparison of Scaling and Correlational Analysis of Perceptions of Mathematics Objectives

*Mathematics teachers from university, vocational colleges, and high schools were presented with a paired comparison task on the relative importance of a set of mathematics objectives. Responses were analysed using correlational and multidimensional scaling techniques. Despite substantial individual differences, there was more agreement within than across institutional types. There were substantial differences between university and vocational teachers, with secondary teachers in the middle. Unequivocal labelling of the scaling dimensions was not possible, but they showed clear separation of university from vocational teachers. Discussion focuses on the relationship between the two analyses and on the practicality of scaling analysis for future research, with some discussion of the curricular implications of the substantive results.*

This study has two purposes, one methodological and the other substantive, the first being more central. The purposes are: first, to investigate the feasibility of multidimensional scaling as a tool for the analysis of perceptions of the relative importance of curricular objectives; and second, to examine the relative importance of a set of objectives of the high school mathematics program. The particular aspect of the school program chosen should be thought of as an example, although not without its own importance.

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One of the more persistent dilemmas of those attempting curriculum reform is the difficulty of changing, despite administrative mandate, the actual teaching processes in place at the classroom level (see, for example, Fullan and Pomfret, 1977). As reported in the literature, many attempts at "top-down" innovation fail. This is probably due to inertial forces which induce teachers to carry on with their teaching in the same manner as they always have, regardless of the hopes and admonitions of program developers, text writers, or supervisory personnel.

One perspective from which to view this situation is that of the teachers' perceptions of what is important in the subject matter at hand. It can be hypothesized that, when teachers deviate from suggested or prescribed topics or teaching methods, they do so in a direction which corresponds to their own biases. Further, one might expect a substantial relationship between the degree of disagreement with "official" priorities and the amount of deviation from prescribed curricula. Multidimensional scaling, particularly in individualized form (Carroll & Chang, 1970), offers a tool by which perceptions of similarity, in this case similarity of importance, may be compared both across individuals and across groups.

This study was designed to investigate the extent of agreement on priorities among the objectives of a high school mathematics program as judged by three groups of mathematics teachers—high school, postsecondary district vocational schools, and first year university—and particularly to evaluate scaling procedures as a curriculum research technique. Recent national surveys have been conducted in the United States (Priorities in School Mathematics, 1981) and in Canada (Worth *et al.*, 1981) on the preferences of various concerned groups for alternative content topics and instructional goals. A wide range of priorities was found within the lay, school, and postsecondary education groups of respondents as well as between these various groups. The perceptions of teachers, besides differing from those of other groups, such as parents or teacher supervisors, also differed greatly even among themselves. In this study, we attempt to draw a link between the perceptions of priorities among teachers and the assumed needs and interests of the students they teach.

Data were collected by a preference questionnaire, and analyzed by correlational and multidimensional scaling techniques. The main focus of this report is to compare the two analytic approaches, with a view to demonstrating the possible information available, using the scaling techniques, from ratings of the importance of objectives.

Although no attempt was made in this study to link perceptions of priorities with teaching practice, the substantive results have the potential for influencing the direction of research, for example, differences between curriculum as planned and as implemented; teacher training, particularly attitude development; and curriculum development and implementation. By introducing a technique relatively unknown in curriculum research, it was hoped that other applications of interest in other substantive fields would be encouraged.

The reasons for teachers holding the views they do may be very complex. However, it is a reasonable supposition that these views are related to the needs of the students with whom they have the most contact, to the teachers' perceptions of these needs, and to the teachers' own backgrounds. Using mathematics as an example, teachers of technology students in a vocational school might be expected to view mathematics very much as an applied subject and hold beliefs about

mathematics which paint it as a servant of science and technology rather than as an end in itself. On the other hand, highly trained academic mathematicians, teaching at the university level, might be expected to bend more toward pure rather than applied mathematics.

Teachers at the high school level are accustomed to a wide variety of students, from future university mathematics majors to those barely able to cope with the most basic skills. Thus they might be expected to vary considerably in their perceptions of priorities. This particular study is set in the Newfoundland context, with provincially set external exams required for high school graduation. It might therefore be supposed that this constraint imposes a degree of unity on the perceptions of teachers not found in other jurisdictions.

While the above discussion contains an outline of broad expectations for findings of the study, there is no intention to suggest that place of employment is the sole or even the major determinant of curricular priorities. The three groups described may serve as useful categorizations, but substantial inter-individual differences, even within the groups, were expected. The working hypothesis in the study was that there would be, despite individual variations, more agreement on priorities within each institutional type than across institutional types.

### *Instrument*

A set of nine major content areas were selected by the authors to cover the major topics of the academic level (postsecondary bound) mathematics curriculum for the final year of high school in Newfoundland. A panel of mathematics teachers agreed that, given a limited number of content areas, these nine were a good representation of the mathematics program. As will be seen below, the nature of the rating task required of respondents imposed a limit on the number of objectives chosen. Within each content area, two objectives were written. The objectives dealt with the following content areas:

1 and 2 — computational skills
3 and 4 — measurement
5 and 6 — geometry
7 and 8 — graphing and data analysis
9 and 10 — algebraic algorithms
11 and 12 — mathematical functions
13 and 14 — probability and statistics
15 and 16 — mathematical proof
17 and 18 — applications of mathematics

Within each pair, the first member was written at a low level of cognitive complexity, and the second at a higher level. The first member of each pair might be considered to be addressed to the lower levels of cognitive skill and the second to the higher levels.

The eighteen objectives are as follows:

1. To acquire the basic computational skills related to the real number system and its subsets, including associated algorithms.
2. To develop efficiency in computations through understanding of the operations and properties of the number systems.
3. To develop a facility for measurement of length, area, volume, etc.
4. To develop understanding of precision and estimation in measurement, and their effect in interpreting solutions to problems.

5. To state geometric properties dealing with such topics as similarity, congruence and right triangles.
6. To develop an understanding of the structure of geometry, including the generation of geometric relationship from basic assumptions.
7. To take a set of data, tabulate it, and present it in meaningful graphical form.
8. To analyze, interpret, and draw inferences from data presented in graphs and tables.
9. To develop algebraic skills such as the use of algorithms, simplification of expressions and the solving of equations and inequalities.
10. To justify the sequence of steps used in any algebraic algorithm.
11. To represent the relationship between sets of numbers by using graphs, tables and algebraic or trigonometric sentences.
12. To recognize the concept of function as being relevant and unifying for the various branches of mathematics.
13. To apply basic principles of probability and statistics such as mean, mode and standard deviation.
14. To interpret statistical data for the purpose of making inferences or drawing conclusions.
15. To follow the steps in a given proof by comprehending the sequence of the premises and conclusions involved.
16. To carry through a consistent argument to a valid conclusion.
17. To identify applications of mathematics to the physical sciences, industry, technology and consumerism.
18. To select appropriate mathematical procedures in order to help solve a specific real life problem.

In general, those we describe as being lower level call for the algorithmic demonstration of routine skills or knowledge, while the higher level objectives call for fuller understanding of the principles behind the more routine objectives. Although our panel reached agreement on the validity of our nine by two conceptualization of the mathematics curriculum, we recognize the possibility of other, quite different ways of viewing mathematics.

To form our questionnaire, all possible pairs (153) of the objectives were placed in random order, and a random half of the pairs reversed. The pairs of objectives were reproduced on 17 pages, 9 to a page. Each subject was presented with the pages in random order. A second copy of one of the pages was randomly chosen, and placed at the front of the questionnaire for practice and to serve as a check on consistency. The random order of pages was disturbed to ensure that the duplicate of this practice page was near the end of the questionnaire. The second response to this page was incorporated into the final results, while the first was used as a check on consistency.

Subjects were asked to indicate which member of each pair of objectives they considered more important for the high school matriculation curriculum. (This stream is the middle of three in the Newfoundland curriculum. It is acceptable for university entrance and many of the vocational school programs.) No other instructions were provided.

### *Sample*

There were three groups of teachers asked to respond to the questionnaire: a random sample of 50 high school teachers of grade ten or eleven academic mathematics (Newfoundland high school ended at grade eleven at the time of this study, 1979); a second random sample of 50 mathematics teachers from the provincial district vocational school system; and all 30 teachers of first year mathematics at Memorial University, the only university in the province.

With follow-up, usable responses were obtained from 24, 31, and 18 teachers from each of these three groups respectively. The low response rate might bias the substantive conclusions of our report, but not the methodological points. We suspect, however, that any bias would be slight, and would tend merely to overrepresent the opinions of those who took the trouble to respond to our request. As well as these 73 respondents, a different sample of 13 high school teachers was asked to complete the questionnaire twice, three weeks apart, to allow for estimation of test-retest reliability.

### *Analysis*

Data were first checked for completeness. One subject who inadvertently missed a page was dropped from the analysis. There were eight cases of skipped items (of 11 169 judgements). These items were randomly assigned to a choice.

Next, a set of preference scores was developed for each respondent. These consisted of a value for each objective from 0 to 17, corresponding to the number of other objectives over which each one was chosen. From these data, group average preference scores were calculated for each group of teachers, and for the entire group of 73.

From these individual preference score sets, a 73 person by 73 person correlation matrix was calculated, giving the correlation of each respondent's choices with all others. Using correlational methods, these data were used to address the purposes outlined in the introduction.

The first step in the scaling analysis was to rearrange each person's data into a dominance half-matrix, as shown in Figure 1(a). In these matrices, a 'l' indicates that the row objective was chosen over the column, and a '0' the opposite. Next, using each individual's preference scores, an index of dissimilarity was calculated for each pair of objectives. The index consisted of the absolute difference between the preference scores for each pair of objectives. For example, from Figure 1(a), objectives 3, 4, and 7 were chosen over, respectively, eleven, three and twelve other objectives. The dissimilarity scores are: for the pair (4, 3), 8; for (7, 3) l; and for (7, 4), 9. (See Figure 1(b) for these values.) Note that, with this technique, the preference information is lost. That is, if the preference scores for objectives 3 and 4 had been reversed (e.g., 3 and 11 rather than 11 and 3), the dissimilarity score for the pair would still be 8. One possible function of multidimensional scaling is the recovery of this directional preference information from non-directional dissimilarity information. While, in this case, the advantages of such a property of scaling methods may not be clear, recovery is clearly beneficial in situations where only dissimilarity information is available.

A scaling analysis was performed on the set of 73 dissimilarity half-matrices, using the INDSCAL procedure (Carroll & Chang, 1970), in the revised and more efficient SINDSCAL algorithm (Pruzansky, 1975). Since detailed discussion of the mathematical models underlying various scaling techniques is beyond the scope of

this article, the reader is referred to the original references or, for a slightly less mathematical treatment of the principles involved, to MacCallum (1974). A sketch of the methodology is incorporated below.

Individualized scaling, in a manner similar to a three-dimensional factor analysis, produces a set of loadings of objectives on dimensions, which might indicate, through interpretation, the grounds on which judgements differ, and a second set of loadings of individuals on the same dimensions, indicating how important, or salient, that particular dimension was in the individual's judgements. For example, Carroll and Wish (1974) presented subjects with a task requiring ratings of the similarity of nations. Results showed that subjects discriminated among nations on two dimensions, labelled by the authors as "developed-underdeveloped" and "communist-western." Respondents were independently categorized as "hawks" or "doves." It was found that the hawks gave more salience to the communist-western dimension, and the doves more to the developed-underdeveloped dimension. Thus, for example, hawks rated China and India relatively far apart, while doves rated them relatively similar.

Although analysis in the current study was done in four, three, two and one dimensions, goodness-of-fit measures for SINDSCAL, as well as considerations of interpretability suggested that the two-dimensional solutions were most meaningful. Only two-dimensional solutions are reported here.

By comparing saliences of the dimensions for individual members of each of the three groups of teachers, we can come to some understanding of group differences in perceptions. However, such analysis is limited because SINDSCAL results are non-arbitrary and thus cannot be rotated in the manner of, for example, Varimax rotation of factor analytic results (Carroll & Chang, 1970). In order to provide a more precise comparison between groups, a second type of scaling analysis must be introduced. The second analysis was performed using the MDSCAL program (Kruskal, 1964a, 1964b) in version 5M (Kruskal & Carmone, 1971). Individual dissimilarity matrices [as in Figure 1(b)] were averaged, producing a group average matrix for each of the three groups of teachers. In MDSCAL, as with the SINDSCAL procedure, objectives are put into a many-dimensional space depicting, in a manner analogous to factor analysis, the dissimilarities among objectives. Inspection of the meanings of the points, in this case, objectives, provides labels for the dimensions and, by inference, reasons for differences in perception among subjects. While a standard rotational procedure such as Varimax might be appropriate for the MDSCAL results, in this study a rotation to a target matrix under conditions or arbitrary translation of origin and dilation of dimensions (Schonemann & Carroll, 1970; Lingoes and Schonemann, 1974) was used. Each group solution was rotated to the group average space of the SINDSCAL solution. This rotation produces a measure of fit, a matrix equivalent of a coefficient of alienation, which can be related to a Pearson correlation coefficient. As well as rotations to the SINDSCAL results, the group MDSCAL results were rotated to each group in order to assess the degree of correspondence between groups. Thus, use of MDSCAL gives quantitative comparisons between group scaling results.

Finally, in an attempt to shed light on the differences in perception, the results of individuals who differed markedly in their dimension loadings in the SINDSCAL analysis were examined.

Column Objectives

| Row Objectives | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 | | | | | | | | | | | | | | | | |
| 3 | 1 | 1 | | | | | | | | | | | | | | | |
| 4 | 1 | Ø | Ø | | | | | | | | | | | | | | |
| 5 | Ø | Ø | Ø | Ø | | | | | | | | | | | | | |
| 6 | Ø | Ø | Ø | Ø | Ø | | | | | | | | | | | | |
| 7 | Ø | Ø | 1 | 1 | 1 | 1 | | | | | | | | | | | |
| 8 | Ø | Ø | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | |
| 9 | Ø | Ø | Ø | 1 | 1 | 1 | Ø | Ø | | | | | | | | | |
| 10 | Ø | Ø | Ø | 1 | Ø | Ø | Ø | Ø | Ø | | | | | | | | |
| 11 | 1 | 1 | 1 | 1 | 1 | 1 | Ø | Ø | 1 | 1 | | | | | | | |
| 12 | Ø | Ø | Ø | 1 | Ø | Ø | Ø | Ø | Ø | Ø | Ø | | | | | | |
| 13 | Ø | Ø | Ø | 1 | 1 | 1 | Ø | Ø | Ø | 1 | Ø | 1 | | | | | |
| 14 | Ø | 1 | 1 | 1 | 1 | 1 | Ø | Ø | 1 | 1 | 1 | 1 | 1 | | | | |
| 15 | 1 | Ø | Ø | 1 | Ø | Ø | Ø | Ø | Ø | Ø | Ø | 1 | Ø | Ø | | | |
| 16 | 1 | Ø | Ø | 1 | 1 | 1 | Ø | Ø | 1 | 1 | Ø | 1 | 1 | 1 | 1 | | |
| 17 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

(a) Individual Respondent Dominance Matrix
(1 = row objective preferred over column objective)

Column Objectives

| Row Objectives | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | | | | | | | | | | | | | | | | |
| 3 | 2 | 1 | | | | | | | | | | | | | | | |
| 4 | 6 | 9 | 8 | | | | | | | | | | | | | | |
| 5 | 5 | 8 | 7 | 1 | | | | | | | | | | | | | |
| 6 | 6 | 9 | 8 | Ø | 1 | | | | | | | | | | | | |
| 7 | 3 | Ø | 1 | 9 | 8 | 9 | | | | | | | | | | | |
| 8 | 4 | 1 | 2 | 1Ø | 9 | 1Ø | 1 | | | | | | | | | | |
| 9 | 2 | 5 | 4 | 4 | 3 | 4 | 5 | 6 | | | | | | | | | |
| 10 | 6 | 9 | 8 | Ø | 1 | Ø | 9 | 1Ø | 4 | | | | | | | | |
| 11 | 3 | Ø | 1 | 9 | 8 | 9 | Ø | 1 | 5 | 9 | | | | | | | |
| 12 | 8 | 11 | 1Ø | 2 | 3 | 2 | 11 | 12 | 6 | 2 | 11 | | | | | | |
| 13 | 3 | 6 | 5 | 3 | 2 | 3 | 6 | 7 | 1 | 3 | 6 | 5 | | | | | |
| 14 | 2 | 1 | Ø | 8 | 7 | 8 | 1 | 2 | 4 | 8 | 1 | 1Ø | 5 | | | | |
| 15 | 6 | 9 | 8 | Ø | 1 | Ø | 9 | 1Ø | 4 | Ø | 9 | 2 | 3 | 8 | | | |
| 16 | 1 | 2 | 1 | 7 | 6 | 7 | 2 | 3 | 3 | 7 | 2 | 9 | 4 | 1 | 7 | | |
| 17 | 7 | 4 | 5 | 13 | 12 | 13 | 4 | 3 | 9 | 13 | 4 | 15 | 1Ø | 5 | 13 | 6 | |
| 18 | 8 | 5 | 6 | 14 | 13 | 14 | 5 | 4 | 1Ø | 14 | 5 | 16 | 11 | 6 | 14 | 7 | 1 |

(b) Individual Respondent Dissimilarity Matrix
(numbers are differences in preference between row and column objectives)

Figure 1.

In summary, then, results of the within and between group differences based on the correlational analysis were compared with the scaling results. In theory, goodness-of-fit among group scaling solutions should be related to high between-group correlations. The loadings of individuals in the SINDSCAL solution should be related to the pattern of the subject by subject intercorrelation matrix. Formal statements of research hypotheses have not been provided as they would not improve clarity.

## *Results and Discussion*

### *Reliability*

The test-retest stability correlations performed on the preference scores ranged from 0.68 to 1.00, with an average, using Fisher's $z$, of 0.90. This indicates substantial stability of the judgements over time. In the repeated-page individual consistency measures, on a total of nine possible agreements, only 10 of the 73 subjects had fewer than six agreements. The other 63 had between six and nine. The average was 7.3 agreements of a possible 9, or 81%.

TABLE 1
RANK ORDER OF PREFERENCES

| Objective | High School ( =24) | Vocational School ( =31) | University ( =18) | Total Group ( =73) |
|---|---|---|---|---|
| 1. Computation-L | 4 | 5 | 3.5 | 4 |
| 2. Computation-H | 3 | 2 | 3.5 | 2 |
| 3. Measurement-L | 11 | 6 | 17 | 13 |
| 4. Measurement-H | 15 | 4 | 13 | 9 |
| 5. Geometry-L | 14 | 15 | 12 | 16 |
| 6. Geometry-H | 8 | 14 | 5 | 10 |
| 7. Graphing-L | 12 | 10 | 15 | 12 |
| 8. Graphing-H | 7 | 8 | 11 | 7 |
| 9. Algorithms-L | 2 | 9 | 1 | 3 |
| 10. Algorithms-H | 17 | 18 | 10 | 17 |
| 11. Functions-L | 6 | 13 | 7 | 8 |
| 12. Functions-H | 16 | 16 | 8 | 15 |
| 13. Probability-L | 18 | 17 | 18 | 18 |
| 14. Probability-H | 13 | 11 | 16 | 14 |
| 15. Proof-L | 10 | 12 | 9 | 11 |
| 16. Proof-H | 5 | 7 | 2 | 5 |
| 17. Applications-L | 9 | 3 | 14 | 6 |
| 18. Applications-H | 1 | 1 | 6 | 1 |
| SUM--Low level objectives | 86 | 90 | 96.5 | 91 |
| SUM--High level objectives | 85 | 81 | 74.5 | 80 |

$r_{HS\text{-}DVS} = 0.65$; $r_{HS\text{-}U} = 0.73$; $r_{DVS\text{-}U} = 0.21$

HS - high school
DVS - district vocational school
U - university

### *Preference rank orders*

In Table 1, the rank order of the preferences of each group of teachers, as well as the entire sample are presented. The two bottom rows show summed ranks for high and low level objectives. Overall, there was a slight trend to favour the higher level statements of the objectives, varying from no effect for the high school teachers to a substantial effect for the university teachers. Between-group correlation matrices are footnoted to the table. The relationships between rankings across groups were modest in two cases and quite small between the vocational school and university teachers. Looking at individual topics, the most noticeable differences were the relative importance of measurement and applications to the vocational school teachers, and the lack of importance of functions and geometry

to them. Overall, measurement, geometry, and probability were the least important, applications and computations the most important. Except for algorithms and functions, the trend was for the higher level objective of each pair to be rated as more important.

*Correlational analysis*

The results of the correlational analysis of the preference scores are reported in Table 2. After converting to Fisher's $z$, the average correlation within each group and across each pair of groups was calculated. These are reported in Table 2(a). The results of the analyses of variance on the sets of Fisher's $z$-scores among all members of the groups indicated are reported in Table 2, (b) to (e). In the latter three cases, the two within group sets of scores were pooled for comparison with the scores between the same two groups. It was observed that, most importantly, average correlation was quite small between individuals, indicating that individual variation rather than place of employment is still the most important factor in perceived priorities. Also, as indicated by the results of Table 2(b), group membership did play some role in the perceptions. There was most agreement among university teachers and least among high school teachers. From the rest of the table [(c) to (e)] it was concluded that, for two of the three comparisons, there was significantly more agreement among members of particular groups than there was between those two groups.

TABLE 2
SUMMARY OF CORRELATIONAL ANALYSIS[a]

(a) Average Correlation

| | HS | DVS | U |
|---|---|---|---|
| HS | 0.22 | | |
| DVS | 0.20 | 0.27 | |
| U | 0.23 | 0.08 | 0.35 |

| Source | SS | df | MS | $F$ | $p$ |
|---|---|---|---|---|---|
| (b) Anova, within three groups | | | | | |
| Between | 1.903 | 2 | 0.952 | 7.08 | .001 |
| Within | 119.807 | 891 | 0.1345 | | |
| (c) Anova, within vs. across, HS and DVS | | | | | |
| Between | 0.853 | 1 | 0.853 | 6.76 | .01 |
| Within | 187.26 | 1483 | 0.1263 | | |
| (d) Anova, within vs. across, HS vs. U | | | | | |
| Between | 0.259 | 1 | 0.259 | 1.91 | .17 |
| Within | 116.30 | 859 | 0.1354 | | |
| (e) Anova, within vs. across, DVS vs. U | | | | | |
| Between | 12.575 | 1 | 12.575 | 94.9 | 0.00 |
| Within | 155.529 | 1174 | 0.1325 | | |

[a] HS - high school
DVS - district vocational school
U - university

*Scaling results*

In Table 3, the stimulus weights (objective weights) for the two-dimensional SINDSCAL solution are reported. Even though at first glance it seems that information similar to the ranking analysis of Table 1 has been recovered by the scaling, interpretation is not clear. The dimensions of the scaling solution are correlated 0.69 and -0.67 with the preference rankings of the right hand column of Table 1, and -0.07 with each other. (The negative signs are an artifact of the scaling analysis, and can be ignored.) Neither dimension can be simply labelled, "preference." Also, it seems clear that neither dimension can be labelled on the basis of the lower and higher cognitive levels required of the objectives. In almost all cases, objectives from the same content area load toward the same end of the dimension. Rather than impose any wishful thinking on the results, the factors shall remain unlabelled. Despite this problem of interpretation, the results reported in Figure 2 suggest that the scaling results are not meaningless.

TABLE 3

TWO-DIMENSIONAL SINDSCAL SOLUTION

| Objective | Weight | | Rank | |
|---|---|---|---|---|
| | Dimension 1 | Dimension 2 | Dimension 1 | Dimension 2 |
| 1. Computation-L | -0.098 | 0.374 | 7 | 17 |
| 2. Computation-H | -0.266 | 0.347 | 3 | 16 |
| 3. Measurement-L | -0.260 | -0.192 | 4 | 6 |
| 4. Measurement-H | -0.158 | -0.197 | 5 | 5 |
| 5. Geometry-L | 0.263 | -0.077 | 15 | 7 |
| 6. Geometry-H | 0.199 | 0.159 | 14 | 14 |
| 7. Graphing-L | -0.092 | -0.269 | 8 | 3 |
| 8. Graphing-H | -0.143 | -0.225 | 6 | 4 |
| 9. Algorithms-L | 0.119 | 0.391 | 12 | 18 |
| 10. Algorithms-H | 0.344 | -0.006 | 17 | 10 |
| 11. Functions-L | 0.102 | 0.009 | 11 | 11 |
| 12. Functions-H | 0.408 | -0.022 | 18 | 9 |
| 13. Probability-L | 0.284 | -0.409 | 16 | 1 |
| 14. Probability-H | -0.058 | -0.315 | 10 | 2 |
| 15. Proof-L | 0.151 | 0.100 | 13 | 12 |
| 16. Proof-H | -0.082 | 0.233 | 9 | 15 |
| 17. Applications-L | -0.274 | -0.053 | 2 | 8 |
| 18. Applications-H | -0.437 | 0.152 | 1 | 13 |

In Figure 2 the graph of the loadings of individuals on the two dimensions is presented. As can be seen, there are substantial differences in the saliences of each of the dimensions for the individuals involved. MacCallum and Cornelius (1977) reported results of a Monte Carlo study which demonstrated that interpretation of individual loadings on a dimension can be misleading, as loadings alone measure goodness-of-fit of the group space to an individual's data as much as they do the salience of that particular dimension for the individual. Therefore, the appropriate method of looking for patterns among the individuals is to consider the ratio of loadings on each dimension rather than the loadings themselves. For this reason, Figure 2 has been partitioned into three zones as indicated, on the basis of angular projection from the origin. Each zone contains about equal numbers of individuals. The population of each zone is as follows: top, 10 high school, 4 vocational school,

and 9 university; middle, 7, 9, and 6; bottom, 7, 15, and 0. Remaining subjects were too close to the origin to be partitioned. This breakdown indicates that the top third contains more than its share of university teachers, and less of vocational school teachers. The reverse is true of the bottom third. If we accept the supposition that there should be some systematic differences in perception between vocational school and university teachers, then the SINDSCAL solution has found such a difference, despite our inability to attach clear labels to the dimensions of the solution.

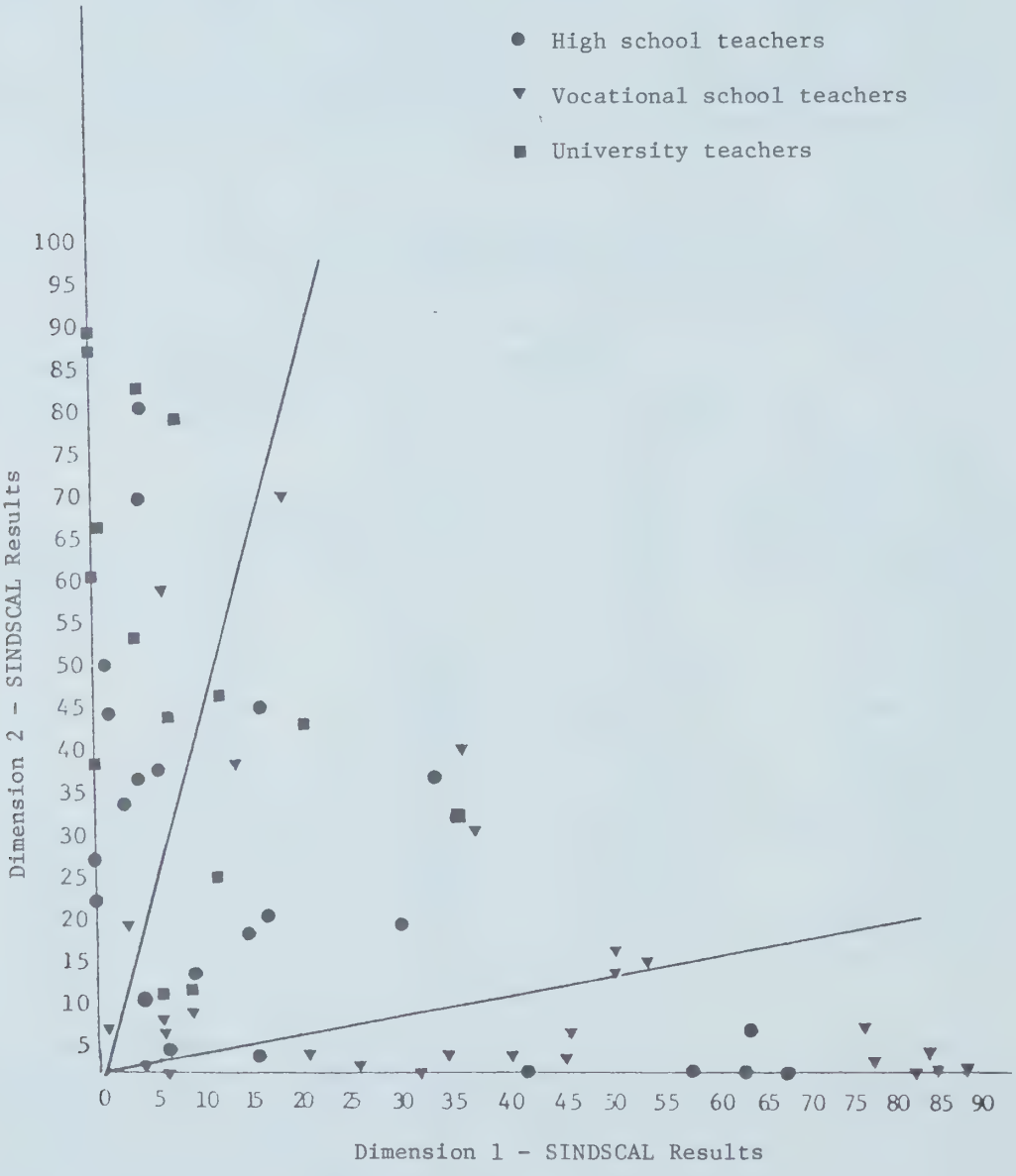


Figure 2.

In the interest of shedding light on the SINDSCAL solution, for each of the two dimensions, two individuals were chosen whose responses were best typified by the dimensions. These results are reported in Table 4. There are clearly major differences between the two pairs of individuals, but these differences defy easy interpretation. Those loading on dimension 1, high school teacher 1 and vocational school teacher 5, seemed to favour measurement, graphing, and applied

mathematics, while putting a very low priority on functions. Those loading on dimension 2, university teacher 6 and high school teacher 23, put high priority on algorithms and geometry, at the expense of measurement, graphing, probability, and applications. Clearly, more probing of the data is necessary to determine the nature of the underlying structure of the perceptions of these objectives. Unfortunately, data were collected anonymously, so that the individuals concerned could not be interviewed in an attempt to probe their reasoning.

TABLE 4
COMPARISON OF THE TWO PAIRS OF SELECTED INDIVIDUAL PREFERENCES

| | Pair 1 | | Pair 2 | |
|---|---|---|---|---|
| | HS1 | DVS5 | U6 | HS23 |
| Loading, Dimension 1 | 0.66 | 0.84 | 0.00 | 0.04 |
| Loading, Dimension 2 | 0.00 | 0.00 | 0.89 | 0.80 |
| Objectives & Ranks | | | | |
| 1. Computation-L | 10 | 9.5 | 2 | 3.5 |
| 2. Computation-H | 5 | 6.5 | 2 | 5.5 |
| 3. Measurement-L | 7.5 | 2 | 17 | 14 |
| 4. Measurement-H | 15.5 | 4 | 14.5 | 17 |
| 5. Geometry-L | 13 | 15.5 | 8.5 | 7.5 |
| 6. Geometry-H | 15.5 | 13.5 | 4 | 1 |
| 7. Graphing-L | 5 | 5 | 14.5 | 14 |
| 8. Graphing-H | 3 | 9.5 | 13 | 14 |
| 9. Algorithms-L | 11 | 17 | 2 | 2 |
| 10. Algorithms-H | 15.5 | 13.5 | 6 | 7.5 |
| 11. Functions-L | 5 | 12 | 12 | 10.5 |
| 12. Functions-H | 18 | 18 | 10.5 | 9 |
| 13. Probability-L | 12 | 15.5 | 18 | 18 |
| 14. Probability-H | 7.5 | 9.5 | 16 | 16 |
| 15. Proof-L | 15.5 | 9.5 | 10.5 | 5.5 |
| 16. Proof-H | 9 | 6.5 | 5 | 3.5 |
| 17. Applications-L | 2 | 2 | 8.5 | 12 |
| 18. Applications-H | 1 | 2 | 7 | 10.5 |

The unrotated loadings for the MDSCAL group solutions are not reported. The rotated loadings, as rank orderings, are reported in Table 5, using the SINDSCAL full group solution as the rotation target. Conversion of the goodness-to-fit measures to correlation coefficients gave the following relationships between the total group SINDSCAL results and the MDSCAL results for each of the three groups: high school, 0.92; vocational school, 0.70; university, 0.66. One interpretation of these results is that the high school teachers' perceptions dominate the SINDSCAL group space more than the other groups. Referring back to Table 2, the high school teachers were the group within which there was the least agreement on priorities, which supports our earlier suggestion that perceptions are influenced by the range of interests and abilities of the students taught. Thus, we might hypothesize that their results dominated the SINDSCAL space due to their greater inter-individual variance. Such a speculation could be pursued by further analysis involving those individuals whose data did not fit the group SINDSCAL space very well.

TABLE 5
ROTATED MDSCAL SOLUTIONS (SINDSCAL TARGET)

| Objective | SINDSCAL Target | | High School | | Vocational School | | University | |
|---|---|---|---|---|---|---|---|---|
| | Dim 1 | Dim 2 | Dim 1 | Dim 2 | Dim 1 | Dim 2 | Dim 1 | Dim 2 |
| 1 | 7 | 17 | 9 | 17 | 8 | 16 | 17 | 17 |
| 2 | 3 | 16 | 8 | 16 | 2 | 17 | 10 | 16 |
| 3 | 4 | 6 | 3 | 8 | 4 | 18 | 2 | 3 |
| 4 | 5 | 5 | 12 | 5 | 5 | 13 | 8 | 5 |
| 5 | 15 | 7 | 18 | 12 | 15 | 14 | 6 | 8 |
| 6 | 14 | 14 | 15 | 14 | 13 | 8 | 9 | 14 |
| 7 | 8 | 3 | 7 | 3 | 9 | 9 | 15 | 4 |
| 8 | 6 | 4 | 5 | 6 | 7 | 5 | 16 | 6 |
| 9 | 12 | 18 | 11 | 18 | 11 | 15 | 14 | 18 |
| 10 | 17 | 10 | 17 | 9 | 18 | 7 | 3 | 13 |
| 11 | 11 | 11 | 10 | 10 | 14 | 11 | 13 | 9 |
| 12 | 18 | 9 | 16 | 7 | 17 | 3 | 18 | 10 |
| 13 | 16 | 1 | 14 | 1 | 16 | 4 | 7 | 2 |
| 14 | 10 | 2 | 6 | 4 | 20 | 2 | 12 | 1 |
| 15 | 13 | 12 | 13 | 11 | 12 | 6 | 4 | 11 |
| 16 | 9 | 15 | 2 | 15 | 6 | 1 | 5 | 15 |
| 17 | 2 | 8 | 4 | 2 | 3 | 10 | 1 | 7 |
| 18 | 1 | 13 | 1 | 13 | 1 | 12 | 11 | 12 |

Rotation of the group MDSCAL results to each other, and subsequent conversion of the measures of fit to correlation coefficients showed the following relationships: high school with vocational school, 0.69; high school with university, 0.60; vocational school with university, 0.11. It was decided not to report the statistical significance of these correlations or of the differences between them, as it is not clear that the matrix coefficents of alienation, which form the basis for the reported correlation coefficients, have a simple sampling distribution. These results, referring back to Table 2 again, do not reflect directly the pattern of the simple correlational analysis. The present results showed the high school perceptions of priorities more closely related to those of the vocational schools than the universities, while Table 2 showed the reverse, although the differences are not large. In both analyses, the relationship between vocational school and university priorities is the lowest. Although the specific reasons for this lack of agreement are not clear, note that the correlational analysis takes into account within-group variation while the MDSCAL technique, based on group average data alone, ignores this variation. Further analysis would be needed in order to be more specific about the reason for this discrepancy.

## *Summary and Conclusions*

In this study, there are results of both substantive and methodological interest, as well as ample room for further investigation in both realms. Simple correlational analysis showed that there were both commonalities and differences

across teachers in their perceptions of priorities in mathematics education. Neither the rank ordering nor the scaling results showed any simple pattern in the perceptions, although there was evidence of preference for objectives aimed more at the higher levels of cognitive skill. The two methods of analysis showed considerable, but not perfect, agreement in the estimation of across-group agreements.

As mentioned earlier, academic mathematics classes often consist of students with many and varied career interests. From the results of this study, it may be concluded that, as a group, teachers attempt to meet the needs of those students who attend university or a trades school. This assumes, of course, that teachers emphasize in class the objectives they report to be most important in surveys such as this, and that they have, in fact, interpreted the questionnaire items similarly. As individuals, however, many secondary school teachers appear to focus on the needs of one group more than the other. It is quite possible that the special needs of those students not pursuing a postsecondary education are not met at all in the academic program. Several curricular questions, not directly addressed in this study can now be asked. Is the curriculum so ill-defined that its objectives can be interpreted quite differently by different teachers? Is it possible to develop a curriculum that will meet the needs of such a diverse group of students? Are teachers interpreting the curriculum in a manner which meets the needs of *all* of their students and, if not, how can teacher education programs be structured to teach them to do so?

Although specific recommendations with respect to content are difficult and perhaps dangerous to make when based on data from a short list of objectives and a low response rate, several implications for teachers appear evident. Particularly for those students who aspire to attend university, more emphasis needs to be placed on higher level objectives. One specific example of this is the presentation of the function concept as a unifying theme in mathematics. For those who plan to attend a trades school, teachers should consider a greater emphasis on measurement concepts as well as applications from various trades and technologies.

If we wish to generalize from Newfoundland to other jurisdictions, it must be emphasized that, due largely to the provincial examination system in place in that province, there is more centralized curriculum control than in most other provinces. Thus, one would expect that there would be even more curricular diversity and disagreement over priorities in other jurisdictions. Such a hypothesis is, of course, subject to investigation.

The rationale for much of this type of research is that perceptions of priorities have an effect on teacher choice of topics, allocation of time, classroom behaviour, and ultimately, on student achievement. Observational studies, focussing on a smaller number of teachers, and perhaps a smaller number of objectives, would be needed to establish relationships of this type. In this study, these links remain unexamined.

With this and similar data sets, however, further analysis is possible. For example, it may be possible to find relationships among other teacher variables and perception of priorities. As already mentioned, an obvious supplementary analysis is to run SINDSCAL on the data from each of the three groups separately. This would probably, given the low degree of agreement across groups, result in substantially different group spaces. There is potential further

information in the data of those individuals who did not fit the group SINDSCAL space very well. These teachers may be marching to the beat of quite a different drummer.

Those individuals who show a wide variation in their preferences for objectives would tend to dominate the group average preferences which were the input to the MDSCAL analysis. Consideration should be given to the possibility of normalizing, within the individual, before averaging.

Other data gathering techniques, involving sorting of objectives into various categories or placing them on a board, although requiring more intensive effort by respondents, may be useful in discovering the underlying reasons for the perceptions of priorities. For example, see Champagne, Klopfer, Desema and Squires (1981), Preece (1976), or Shavelson and Stanton (1975), for discussion of tree diagram construction, hierarchical classification, and other methods.

A word concerning paired comparisons and multidimensional scaling as the analytic tools of choice in this study is appropriate. Commenting on an earlier version of this report, Traub (1981) suggested, in part, that information on perceptions of priorities could be gleaned more easily, and perhaps more accurately, by asking subjects for a simple rank order of priorities among a relatively small number of objectives rather than by asking for a considerably larger number of paired comparative judgements. One could then proceed through correlational analysis of rank orders, and perhaps through averaging within groups of the rank orders of individuals, and produce very similar results to those reported here without resorting to the scaling analysis at all. With reference to the SINDSCAL dimensions which we have chosen to leave unlabelled because of their correlations with the simple preference rankings of Table 1, he suggested that they both be labelled "importance," but "importance from different points of view."

His comments are to the point, and raise the general issue of "why bother" with scaling analysis when less complex methods are readily available. Our answer is that the goal of a study such as this is to attempt to find a more precise definition of the different points of view of different judges of priority. In other words, the purpose is to uncover the implicit meanings of importance which a judge brings to the task. In the present case, the attempt has not been notably successful except to show that the issue is not clearcut. What is needed in a long range program of research in this area is information which validates and elucidates the scaling results, perhaps using interview methods. This, combined with a series of scaling studies, has the long range potential of shedding enough light on the behaviour of scaling algorithms that they will move beyond the stage of developing methodology and begin to make contributions to substantive understanding which other methodologies are incapable of making.

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# Subject-Object and Subsystems Interactions in Problem Solving

*This experiment is an attempt to test Piaget's (1977) notion of "subject-object" and "subsystem" interactions in problem solving. A subject-object interaction, which is here suspected of accounting for variance in problem solving, is that between the amount of haptic experience with the objects of a problem and the ability to anticipate transformations of the mental images of those objects (spatial ability). A subsystems interaction, which is here hypothesized also to account for variance in problem solving, is that between the ability to reproduce static images of the objects (static imagery) to the problem and the ability to anticipate transformations of that same image. The statistical analysis of the experimental data suggests significant haptic/non-haptic by spatial ability interaction and a static imagery by spatial ability interaction accounting for variance in problem solving scores. These statistical interactions are interpreted as substantiation of the hypothesized Piagetian interactions.*

Little has been done to integrate Piaget's notions of problem solving (Piaget, 1977) and mental imagery (Piaget & Inhelder, 1971) with other theoretical frameworks of problem solving (e.g., Guilford, 1967) and spatial abilities (McGee,

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1979; Smith, 1964). It is the intent in this paper to investigate that relationship in the context of data collected to test Piagetian notions.

Piaget's (1977) concept of equilibration may serve as a basis for understanding problem solving. A problem in this framework is the disequilibration that may occur as a result of either a subject-object interaction or an interaction of the subject's subsystems (action or conceptual schemes). Guilford (Guilford, 1967; Guilford & Hoepfner, 1971), on the other hand, alludes to problem solving as consisting of fifteen factors in a factor analysis structure of intellect model. This descriptive model involves mainly the transformation of semantic material and provides little understanding for problem solving processes in general. Consequently, it would be interesting to test a Guilford-style problem solving instrument (e.g., "Predicaments") against Piagetian constructs. A test of greater reliability ("Uncommon Predicaments") was developed by the authors for this purpose.

Guilford's results would suggest that one's problem solving ability is basically an ability to transform semantic material, while Piaget would suggest that one's problem solving ability depends on one's level of operativity. This operativity is related to the ability to make transformations both on semantic and imagery content. Consequently, in Piagetian terms, a measure of one's operativity obtained through tests of spatial ability (i.e., a test of one's ability to transform mental images) should be a predictor of solution rates of verbally stated problems. In addition to this, Piagetian theory would predict significant effects due to the interaction of subsystems and to subject-object interaction affecting problem solution rates. It is expected that these theoretical subject-object and subsystem interactions reveal themselves statistically as treatment by ability and as ability by ability interactions, respectively.

A subsystems interaction of interest in this study is between the structure that can generate a mental image and the operative structures that can transform the image. In a test of verbally stated problems involving concrete objects, use of imagery and transformation of that imagery is advantageous (Paivio, 1971, 1976; Smith, 1964). Piaget and Inhelder (1971) suggest that at the lowest level of development of mental imagery a person is able to reproduce an image of an object that had been previously seen. At the highest level of development of imagery, a person is able to anticipate a transformation of an image. These anticipatory transformations themselves are linked directly to the person's operational level. In statistical terms, a test score of anticipatory transformational imagery, partialling out reproductive, static imagery with an appropriate test score, would be a measure of one's operational level. However, in the absence of an ability to reproduce static images, operative structures have little on which to act. So, in a problem situation where an anticipatory transformation of an image may be advantageous, higher problem solving rates will occur in the presence of both static imagery abilities and higher operational level. The absence of either or both static imagery ability and higher operational level will result in lower problem solving scores. This would reveal itself statistically by the interaction of a static imagery test score (henceforward called "imagery score" for brevity) with an anticipatory, transformational imagery test score, partialling out the imagery score (henceforward called "spatial score" for brevity).

A subject-object interaction was of interest in this study. This involved the subject's tactual-manipulative (haptic) interaction with objects that were

subsequently used in the uncommon predicament written test. Piaget (1954) believed that a child's construction of space (near-far, up-down, left-right) evolves primarily out of the child's manipulation of his/her environmental objects, rather than through vision. While the construction of spatial structures may occur primarily through manipulation, vision does play a role in developing spatial abilities (Hartlage, 1976). Salkind (1976) indicated that spatial visualization is "enhanced by input from the haptic sensory mode." So it was suggested that not only are spatial structures, and hence operative structures, constructed primarily via manipulation but also that they seem to be stimulated by that same modality as well. Data collected by Anderson and Johnson (1966) and by Glucksburg (1964) for other purposes suggested as well that hands-on experience with objects increases solution rates of problems involving those same objects over and above simply seeing those same objects. The cognitive construction of space, mental imagery, and spatial abilities hinges primarily on the development of operative action and cognitive structures, which in turn are reflected by a person's problem solving ability. It is expected that unsighted, haptic manipulation of the objects used in the problem will stimulate spatial structures used for subsequent problem solving. Statistically this will reveal itself as an interaction of a haptic/non-haptic treatment contrast by spatial score, predicting problem solution rate.

In summary, the present experiment is intended to test hypotheses concerning two interactions. First, an imagery by spatial interaction is expected, where those high both in imagery score (static, reproductive imagery) and in spatial score (transformational anticipatory imagery with static, reproductive imagery partialled out) will do better than other combinations of these two scores. Second, a spatial by haptic/non-haptic treatment contrast interaction is expected, where haptic (tactual) manipulation of the objects mentioned in Uncommon Predicaments test stimulates the spatial structures subsequently used in solving problems on this test. This will be revealed statistically by the fact that the slope of the regression line of spatial score predicting problem solving is greater for the haptic group than the non-haptic group.

This investigation is limited to testing solely the above two specific hypotheses concerning interactions. The numerous experimental and statistical controls that were required to test these interactions may unfortunately distract the reader from these central issues. Tests for interactions require seeking differences in *correlations* across groups or across levels of abilities, rather than differences in *central tendency* across groups. It is common in educational research to do the latter and uncommon to do the former, which is the intent of this experiment.

## *Method*

Several controls were included in the design of this experiment. A questionnaire was designed to assess the recency and extent of involvement of the subjects with the objects mentioned in the problem solution sets. Also a second control group was included. The first control group had no intervention between pretests and posttest. The second control group was shown the objects used in the response of the problem solving posttest. These subjects also described or were told how the object is commonly used. This second control group is hereafter called the Functional-Visual (FV) group. The intent of the FV group was to control for awareness of the functional and figural aspects of the objects used in the solution set of the problem solving post test.

*Sample*

Forty-two undergraduate education students enrolled in an introductory educational psychology course, plus 33 graduate students enrolled in a statistics course for the behavioral sciences offered by the Department of Guidance and Educational Psychology at Southern Illinois University served as subjects. About half of the graduate students were doctoral, education students; about a third were doctoral, social sciences students; and the remainder were doctoral, biological sciences students. The sample ages had a mean of 24.5 years, and a median of 22.9 years, with a minimum of 19 years and a maximum of 59 years. There were 29 males and 46 females in the sample. Students were given course credit for participation.

*Materials*

1. Two tests (Form A & B) of verbally-stated problems involving concrete objects, called "Uncommon Predicaments," were developed by the authors. The design evolved from Guilford's (1967; Guilford & Hoepfner, 1971) *Predicaments* test with the additional requirement that many of the objects of the problems were commonly seen but not manipulated. The authors designed the test with the intent (albeit without empirical support) that imaginal rather than semantic transformation would be required for problem solution. Tests involved the solution of a stated problem by use of two objects selected from a set of four.

   *Example*
   Cook a fish when matches are available.
   (a) Books (b) A shoe (c) A portable AM/FM radio (d) A shirt
   Answer: (a) and (c). Reason: The antenna from the radio could skewer the fish, while the books could make a fire.

   Each form had eight such questions. The examinee was to circle the choice of two objects and write a reason for the choice. The score was based on feasibility, efficiency, and clarity, and ranged from 0 to 3 for each question. A maximum score of 24 was possible. Scoring was done by two judges. Interjudge reliability (Pearson *r*) based on 17 scripts taken at random was 0.85 for Form A and 0.96 for Form B. Form B was the dependent variable, while Form A (pretest) was used as a covariate. The tests were not timed.
2. The test of spatial abilities used was Part I of the *Paper Folding Test*, a subtest of the kit of Factor-Referenced Cognitive Tests E.T.S. (French, Ekstrom & Price, 1963). Das, Kirby and Jarman (1975) report a major loading with the simultaneous processing factor, which in turn related significantly with "spatial abilities" (Kirby & Das, 1978). The test demands that one fold and unfold in one's imagination, hence make three dimensional transformations of images. The test requires the ability to make anticipatory transformations of static images.
3. The test of imaginal abilities was Part I of the *Form Board Test*, a subtest of the Kit of Factor-Referenced Cognitive Tests, E.T.S. (French, Ekstrom & Price, 1963). Forisha (1975) found a major loading with her imaginal factor, and no significant correlation with her spatial factor. The test requires the ability to generate and hold a static image for subsequent use without having to make a three-dimensional transformation of the image.

4. A Previous Experience Questionnaire listed the names of the objects used in the response sets of Uncommon Predicaments, Form B. The examinee placed a number from 0 to 5 for each object, which indicated the recency and extent of his/her experience with the object. The sum across the 17 objects indicated the degree of previous experience with the set of objects and was used as a covariate.

*Procedure*

Across the three groups, balance was kept with respect to the number of graduates and undergraduates. Selection of examinees for a given group was random. The procedure for each group was as follows:

*Haptic Experience Group*: Examinee took *Uncommon Predicaments* Form A, *Form Board Test* Part I, *Paper Folding Test* Part I, and *Previous Experience Questionnaire*. Thereafter, examinee was blindfolded, led into another room and given each of the objects mentioned in the response sets of *Uncommon Predicaments* Form B to hold and manipulate. S(he) was then asked to describe the parts of the object as to shape, material, and texture, and then to count the number of parts. Finally, the examinee was to guess what the object was. If the examinee did not know, s(he) was told the name. After being led out of the room, the examinee took *Uncommon Predicaments* Form B. At no time during the intervention did the examinee have visual contact with the objects.

*Control Group*: The examinee took *Uncommon Predicaments* Form A, *Form Board Test* Part I, *Paper Folding Test* Part I, *Previous Experience Questionnaire*, and then *Uncommon Predicaments* Form B. Examinees had no recent interaction with the objects mentioned in *Uncommon Predicaments* Form B.

*Function-Visual (FV) Group*: The examinee took *Uncommon Predicaments* Form A, *Form Board Test* Part I, *Paper Folding Test* Part I and *Previous Experience Questionnaire*. Thereafter, s(he) was led into another room and shown, one at a time, each object mentioned in the response sets of *Uncommon Predicaments* Form B, with instructions to write down the name of the object as given by the experimenter. The examinee was then asked what the usual function of the object is. If the examinee did not know, s(he) was told. After all objects were seen (but not handled), the examinee was directed to another room where s(he) took *Uncommon Predicaments* Form B.

The experiment was conducted for each examinee individually. Time required was about one hour each. Sex, age, major subject, and grade level (graduate, undergraduate) of each examinee were recorded.

## *Results*

A general linear model via multiple regression was used to analyze the data. Forms of *Uncommon Predicaments*, Sex, and the *Previous Experience Questionnaire* were included in the model as covariates. Imagery, Spatial Abilities, Haptic Effect (an orthogonal comparison between the haptic experience group and the remaining groups), FV-Effect (an orthogonal comparison between the Functional-Visual group and the Control Group) were included as main effect independent variables. Standard $Z$ scores were used for all independent measures. The two treatment effects were contrast coded using orthogonal coefficients (Kerlinger & Pedhazur, 1973). First order interactions (a) Haptic Effect x Imagery, (b) Functional-Visual Effect x Imagery, (c) Haptic Effect x Spatial, (d)

Functional-Visual Effect x Spatial, and (e) Spatial x Imagery were included. Although main effects were expected, the primary effects of interest were (a) Haptic x Spatial interaction, and (b) Spatial x Imagery interaction.

TABLE 1
*SS* AND *F* VALUES FOR THE INDEPENDENT VARIABLES IN THE GENERAL LINEAR MODEL[a]

| Source | Independent SS | MS | *F*(df=1,61) |
|---|---|---|---|
| a. Sex | 116.007 | 116.007 | 15.27* |
| b. Form A | 372.7697 | 372.7697 | 49.05* |
| c. Previous Experience Questionnaire | 42.8776 | 42.8776 | 5.64* |
| d. Imagery | 47.5475 | 47.5475 | 6.255* |
| e. Spatial | 36.4468 | 36.4468 | 4.794* |
| f. Haptic/non-Haptic | 53.225 | 53.225 | 7.005* |
| g. FV/Control | 3.0818 | 3.0818 | 0.404 |
| h. Spatial-Quadratic | 21.9655 | 21.9655 | 2.889 |
| i. Imagery × Spatial | 38.9468 | 38.9468 | 5.123*[b] |
| j. Haptic × Imagery | 15.2988 | 15.2988 | 2.011 |
| k. Haptic × Spatial | 50.834 | 50.834 | 6.686*[b] |
| l. FV × Imagery | 43.0663 | 43.0663 | 5.665* |
| m. FV × Spatial | .0786 | .0786 | 0.009 |
| (Common Variability) | (266.5266) | | |
| Error | 463.635 | 7.478 | |
| Total | 1572.337 | | |

* $p < .05$

[a] Full Model $R^2$=70.5%  $F$=11.22  df=(13,61)  $p$<0.0001

[b] Primary Research Interest

The least squares solution of sums of squares for the general linear model appear in Table 1. Shown are the independent contribution of the independent variables in terms of sums of squares and the resulting $F$ test for the various effects. As indicated in Table 1, the main effects of Imagery, Spatial Abilities and Haptic/non-haptic contrast were statistically significant (all $p<.05$). Of more interest to this study, however, were the significant interactions of Haptic x Spatial, and Imagery x Spatial (all $p<.05$). Also, the FV x Imagery interaction was observed ($p<.05$).

The least squares solution of the sample data yielded regression results as depicted in Figures 1, 2, and 3, which are two-dimensional sections of a four-dimensional hyper-surface. For purposes of display, the Imagery and Spatial variables are depicted in $Z$-score form with range from $Z$=-1.5 to $Z$=1.5. For purposes of discussion, high Spatial will refer to the point on the regression solution at $Z$=1.5, while low Spatial will refer to the regression solution at $Z$=1.5. Analogously, reference is made to high and low Imagery.

The Haptic x Spatial interaction ($F=6.86$; df=1, 61, $p<.05$) appears in Figure 1. As hypothesized, high Spatial subjects who experienced Haptic stimulus performed well ($\hat{Y}=14.95$), while their high Spatial counterparts who were not allowed Haptic experience (Control and FV Groups) did not fare as well ($\hat{Y}=11.197$). Low Spatial subjects appeared to perform the same under the Haptic condition ($\hat{Y}=8.76$) as under the non-haptic condition ($\hat{Y}=8.80$).

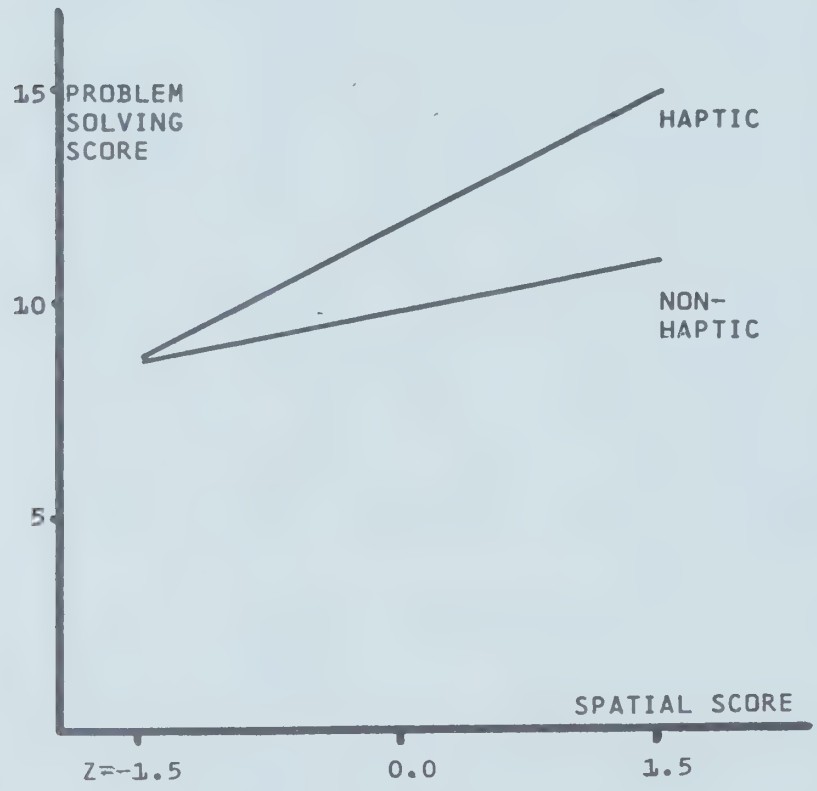


Figure 1. The Haptic Effect by Spatial Abilities Interaction.

The interactive relationship of spatial ability and imagery with problem solving is depicted in Figure 2 ($F=5.123$, $df=1,61$, $p<.05$). The highest solution rate ($\hat{Y}=13.57$) was observed for high spatial-high imaginal subjects. High spatial subjects with low imaginal ability yields lower estimate ($\hat{Y}=10.84$) as expected. The higher solution rate of low spatial-low imagery subjects ($\hat{Y}=9.98$) in comparison to the low spatial-high imagery subjects ($\hat{Y}=6.76$) was an interesting outcome. The slope for the low imagery section indicates that problem solving was independent of spatial abilities in the presence of poor imagery.

Figure 3 shows the interaction observed between the Functional-Visual Effect and Imagery ($F=5.665$, $df=1$, 61, $p<.05$). The treatment effect appeared to make their rate of problem solving independent of imagery. The correlation (Table 2) between the imagery score and the problem solving posttest was $r=-0.079$ ($p>.50$) for the FV group and $r=0.395$ ($p<.05$) for the non-intervention control group.

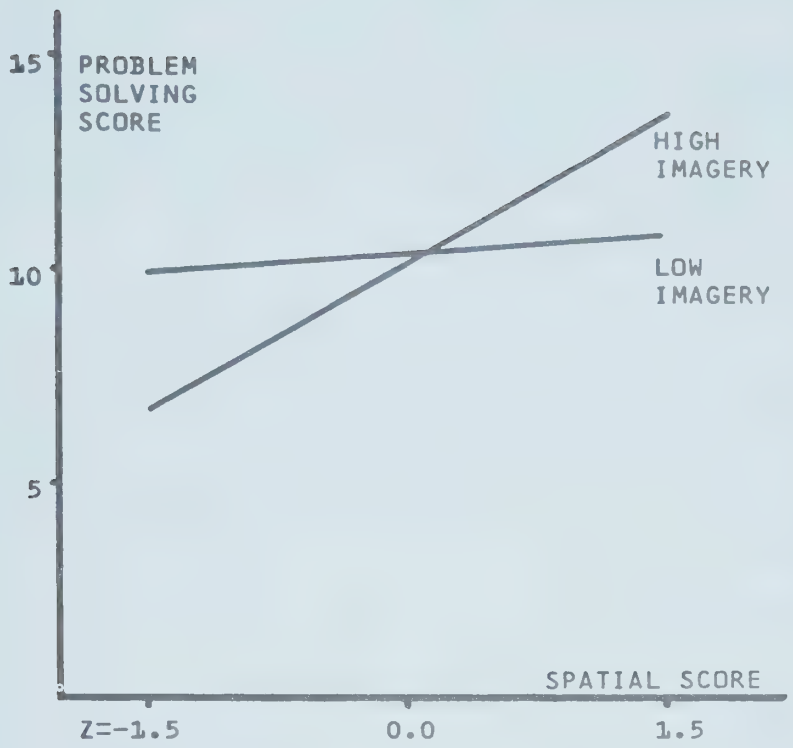


Figure 2. The Spatial by Imagery Abilities Interaction.

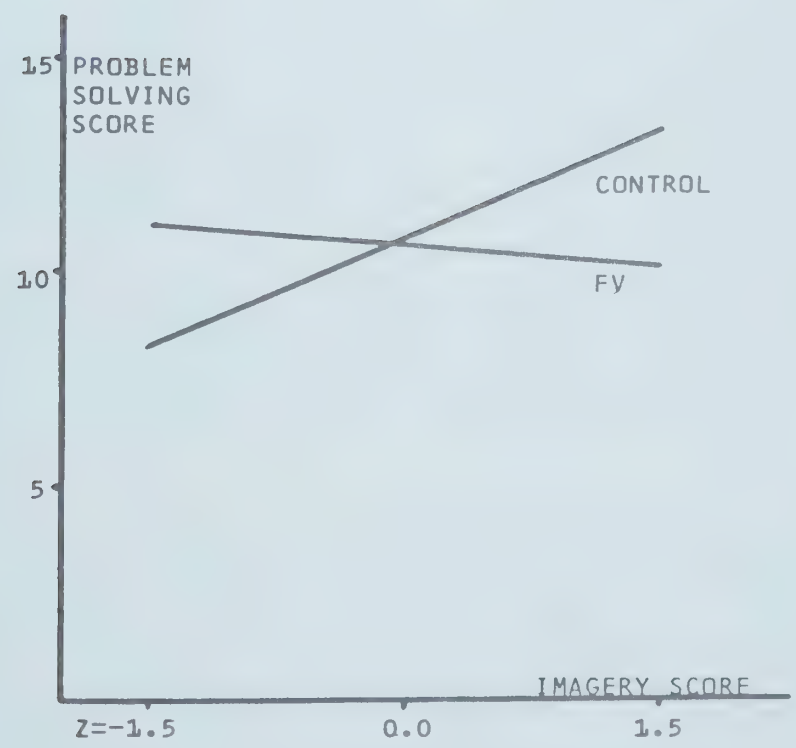


Figure 3. The Functional-Visual Effect by Imagery Interaction.

TABLE 2
CORRELATIONS

| | Posttest | Imagery | Spatial |
|---|---|---|---|
| Haptic Group ($N$ = 25) | | | |
| Pretest | 0.693* | 0.281 | 0.217 |
| Posttest | | 0.166 | 0.499* (.42)[a] |
| Imagery | | | 0.455* |
| Control Group ($N$ =25) | | | |
| Pretest | 0.858* | 0.273 | 0.238 |
| Posttest | | 0.395* | 0.300 |
| Imagery | | | 0.717* |
| FV Group ($N$ = 25) | | | |
| Pretest | 0.368* | 0.167 | 0.000 |
| Posttest | | -0.079 | 0.023 |
| Imagery | | | 0.576* |

* $p < 0.05$

[a] Semi-partial with Imagery partialled out.

## *Discussion*

The results presented above are consistent with Piaget's (1977) notion of subject-object and subsystem interaction in cognitive process. It is apparent from Figure 2 that spatial structures have been stimulated, or activated, by haptic manipulation of concrete objects of a problem. This concurs with Piaget's (1954) idea that the cognitive construction of space begins through one's manipulation of the objects in one's environment. Salkind's (1976) contention, that spatial visualization is enhanced by Haptic "input," has also been confirmed (among adults in this sample).

The "subsystems" interactions postulated by Piaget (1977) also appeared in these results as an imagery by spatial interaction. In this case, the dependence of problem solving on spatial abilities (i.e., a structure to transform a static mental image) was a function of imagery ability (i.e., a structure to form and hold a static mental image). This is now a logical result, but one that has not been tested until the present.

The result that indicates an interaction of FV treatment (contrasted with the non-intervention control) with the static imagery score is indeed interesting. Apparently, of the three groups only the non-intervention control group had its posttest score correlated with the static imagery score. As well, the only group whose posttest score was correlated with the spatial score was the haptic group, while neither the imagery nor the spatial score correlated with the posttest for the FV group. That is, there is no evidence to suggest that the FV group used imagery to solve the verbally stated problems of *Uncommon Predicament* Form B. Therefore, a logical deduction based on Piagetian notions, which may serve as an

hypothesis for future research, is that the FV group solved the problems via semantic transformations.

In conclusion, this experiment and subsequent statistical manipulations of the data serve as another bit of evidence to lend support to the Piagetian concepts of subject-object interactions and subsystem interactions. As well, the experiment points to antecedent conditions that appear to stimulate imaginal structures.

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# Cognitive Processes and Achievement

*Measures on reading, spelling, and mathematics were obtained for 149 students who had previously been identified as either high or low scorers on the dimensions of the Luria model involving sustained attention and simultaneous-successive processing. The reading, spelling, and mathematics variables were analyzed in a multivariate and univariate analysis of variance design, with levels of sustained attention and simultaneous and successive processing as the independent variables. All the achievement variables were significantly related to the sustained attention and simultaneous and successive factors; however, an interaction was obtained for the spelling and reading variables. The results were interpreted in terms of the Luria model.*

Under the influence of information processing and cognitive models of learning, instructional design has recently changed from its traditional role of that of improving the effective acquisition of content, to one that includes the modification and optimization of the processes available to the learner for successful completion of a particular task (Biggs, 1978; Merrill, Kowallis, & Wilson, 1981). Messick (1973) suggested the cognitive processes approach rather than the conventional cognitive abilities approach in the design of instruction; these ideas, together with the aptitude treatment interaction model proposed by Cronbach (1967) encouraged researchers to pursue the relationship between process and achievement (Rothkopf, 1970; Pask & Scott, 1972) and to examine the prospect of process modification (Krywaniuk & Das, 1976; Leasak, Hunt & Randhawa, 1982). One model of cognitive

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processing that has been used in investigations of this kind is the one proposed by Luria (1966, 1973).

In Luria's model (1966, 1973), information is processed under the coordinated influence of three functional systems: arousal, processing, and planning. The arousal system has an activating or inhibiting function, whilst the processing system engages in two forms of activity—simultaneous and successive processing. The link between the arousal system and attention is complex (Lewis & Baldine, 1979). Dykman, Ackerman, Clements and Peters (1971) have suggested that attention consists of the interrelated components of alertness, stimulus selection, focussing, and vigilance. The term vigilance, which is a physiological and psychological readiness to respond, has been defined as that behaviour required to attend to relevant stimuli and ignore irrelevant stimuli over a period of time (Mackworth, 1970). Sustained attention, as operationalized in the present study, is obviously closely related to vigilance which in turn is related to the Luria arousal system in that one manifestation of the Luria functional system will be a variation in vigilance when the subject is involved in a cognitive task. Simultaneous processing, on the other hand, is the integration of individual stimuli into spatial or quasi-spatial groupings, whilst successive processing involves the integration of stimuli in a temporally organized fashion. The processing unit has been operationalized by Das, Kirby and Jarman (1975). The planning unit, essentially a metafunction, concerns itself with the utilization of coded material for achieving a particular goal. Ashman and Das (1980) developed tests to operationalize this component.

The Luria model does not predict simple relationships between the functional units and achievement outcomes and the research results bear this out. For instance, a separate achievement factor emerged when achievement results and processing scores were factor analyzed (Das, 1973). Das, Manos and Kanunga (1975) concluded that both successive and simultaneous processing were important if students were to be generally successful in reading and that the better readers relied more on simultaneous processing. Kirby and Das (1977) demonstrated that those students who measured high in both simultaneous and successive processing also measured high in reading, though neither by itself was sufficient for high achievement. Hunt (1980), in a study of intentional-incidental learning, showed that subjects who were high on the simultaneous factor processed more incidental information. The simultaneous factor has also been found to be related to the long term retention of verbal material (Hunt, Fitzgerald & Randhawa, 1975). What appears to emerge from the research in this area is that the interaction of these processes is complex and is not only dependent upon whether the individual has other processes at his/her disposal to use at his/her option for the attainment of a particular goal, but also dependent upon whether the nature of the task itself requires specific processes for its completion. For example, it could be argued that because arithmetic is dependent upon the ability to survey various parts of the problem as a whole, students high in simultaneous processing should be better at these tasks provided that they are able to deploy this process effectively. Here, obviously, is the link with the planning units mentioned earlier. Hunt (1980) showed that there is a significant interaction between intentional and incidental learning variables and a measure of sustained attention, but no research has looked at the interaction of processing and achievement outcomes. In this regard, it could be hypothesized that when subjects do not have one or the other of the processing units at their disposal, and the task demands the effective deployment

of these units, then provided there is a sufficient amount of sustained attention the goal may be reached, albeit not so efficiently, by relying more on the process that is available. This might not be so in the case of an insufficient amount of sustained attention.

In the present study an attempt has been made to examine the interaction of the processing units and sustained attention with achievement variables.

## Method

### Subjects

The subjects were 165 students comprising the whole of Grades 4 and 5 in one school in Armidale, New South Wales. The mean CA was 130 months.

### Tests

The following tests were administered to 165 students. The tests administered normally comprise the simultaneous-successive battery as used in other reported studies, with the addition in this instance of an additional test to measure sustained attention. All tests were administered as group tests by the senior author.

*Matrix test.* This test was originally developed by Fitzgerald (1971). The test consists of two groups of 20 shapes with each shape drawn on a three by three dot matrix. The test was refined for the present study by analyzing each item for discrimination and difficulty on a separate sample of students. KR-20 reliability coefficients for each part of the test were .79 and .72 respectively. The first part of the test (Matrix A) consists of the momentary presentation (5 seconds) by slide of each shape, after which the student is required to reproduce the shape on a supplied dot matrix. The second part of the test (Matrix B) consists of the presentation of the rest of the shapes in the same manner, but in this instance the student is required to reproduce on the dot matrix supplied the pattern rotated 90 degrees to the right. The matrix test was developed from the statement that disturbance of spatial synthesis is especially prominent when the patient is asked to invert and then draw a presented figure (Luria, 1966), and should be a measure of simultaneous processing. The score for each test was the number correctly reproduced.

*Copying test.* This test was adopted from the copying test of the French, Ekstrom and Price (1963), Kit of Reference Test for Cognitive Factors. The student is given a pattern and asked to reproduce the pattern in a supplied 5 x 5 dot matrix. In this test the student is allowed to view the original pattern the whole time. This test, like the Figure copying test (Ilg & Ames, 1964) used by Das (1973), should give a measure of simultaneous processing. The score was the number correctly copied.

*Digit Span Test.* This test consists of the oral presentation by tape of a series of numbers varying from 4 to 12 digits in length. The student is required to write down the numbers when the series is finished. Unlike the Digit Span used by Das (1973), this test does not present the lists of digits in increasing length, but varies the length randomly over the 24 presentations.

*Letter Span Test.* This test is identical to the digit span test except letters are used. Both tests were selected from the French et al. (1963) Kit of Reference Tests for Cognitive Factors. The scoring for both tests was the number of digits or letters given in the correct order irrespective of intrusions. Both the letter and digit span tests define successive processing.

*Hidden Figures Test.* The original two form test of 36 items was reduced by item analysis to one test of 22 items. Items which did not differentiate between successive and simultaneous factors were disregarded. In this test the student is presented with a complex figure and asked to name which one of four simple figures, given at the top of the page, is contained within the complex figure. Because of the requirement of holding, and in some cases inverting a presented figure, this test becomes primarily simultaneous in nature.

*Word String Test.* This test consists of 20 strings of words presented by tape recorder, at intervals of one second. At the end of each string, the student is required to recall and write down as many of the words as possible. This test is similar to the serial recall tests used by Das (1973) except that Das used 24 lists of four words whilst this test uses 20 lists varying in length from 3 to 8 words presented in random order. Both tests should be tests of successive processing. The scoring of this test was identical to the scoring of the digit and letter span tests.

*Digit/Letter Attention Span Test.* This test consists of the oral presentation by tape of 20 strings of letters and digits. Each string is comprised of a random mixture of letters and digits of varying length and each presentation is preceded by the word, *letters* or *digits*. Depending upon the given instruction, the student is required at the end of each string to write down the appropriate letters or digits. Because the student is required to listen for specific stimuli given within irrelevant material, this test should give a measure of sustained attention. The scoring was the number of digits or letters given in correct order irrespective of intrusions.

*Achievement Battery.* The Gapadol Reading Test (McLeod & Anderson, 1970) was used as a means of reading comprehension. Three subtests of the New South Wales evaluation programme developed jointly by the Australian Council for Educational Research and the New South Wales Department of Education was used to obtain measures of achievement in mathematics and spelling (New South Wales, 1971). The two mathematics tests consist of approximately 50 multiple-choice items in each. The first test measures the basic understandings involved in the operations on counting numbers, whilst the second test measures the underlying principles of rational numbers. The spelling tests consisted of 40 words developed for Grades 4 and 5.

*Design*

The intercorrelations among the nine variables were subjected to an unrestricted common factor analysis using the COSA programme of McDonald and Leong (1976). Confirmatory factor analysis uses existing theory as a reference against which empirical data are tested. Essentially it is based on an unrestricted factor model where the number of factors is testable using a maximum likelihood method. Models of 2, 3 and 4 factors were tested. A 3-factor structure was acceptable [$X^2(12)=10.7$, $p<.05$]. The reader is referred to McDonald (1978) for further details. The resulting factor solution was subjected to a varimax rotation. The factor structure is given in Table 1.

Achievement data were obtained on 149 students and the factor scores for each of these students on the three factors were obtained. A median split of these scores for each factor was taken so that each student was categorized on a high-low dichotomy on each factor. The achievement variables were then analyzed

in a 2 (high-low simultaneous) x 2 (high-low successive) x 2 (high-low attention) multivariate (MANOVA) and univariate (ANOVA) analysis of variance. Because of the differences in cell sizes, the MANOVA and ANOVA effects were tested conservatively by entering a particular effect last in the analyses. Humphreys (1978) suggested that with data of this nature a more powerful test is to use a regression model rather than an analysis of variance model. In the present study, both analyses were attempted, but as almost similar results were obtained, the more conservative results from an analysis of variance are reported. The reader is referred to the article by Das and Kirby (1978) for a rebuttal to the other theoretical concerns Humphreys raises.

TABLE 1
VARIMAX FACTOR LOADINGS FOR THE BATTERY OF TESTS
($N$ = 165)

| Variable | Successive | Simultaneous | Sustained Attention | $h^2$ |
|---|---|---|---|---|
| Matrix A | 16[a] | 84 | 07 | 73 |
| Matrix B | 05 | 66 | 03 | 44 |
| Figure Copying | 30 | 59 | 09 | 45 |
| Hidden Figures | 20 | 53 | 24 | 38 |
| Digit Span | 78 | 19 | 24 | 71 |
| Letter Span | 75 | 15 | 23 | 64 |
| Word String | 60 | 30 | 28 | 53 |
| Digit Attention | 21 | 14 | 75 | 63 |
| Letter Attention | 35 | 08 | 74 | 68 |
| % Variance | 20.7 | 21.6 | 15.3 | 57.6 |

[a]Rounded to two places and decimals omitted.

## *Results*

The multivariate main effects for the simultaneous [$F(4,138)=6.1$, $p<.001$] and successive [$F(4,138)=6.4$, $p<.001$] factors were significant with all corresponding univariate main effects significant also. The high simultaneous and high successive groups did better on all the achievement variables than the corresponding low simultaneous and low successive group.

The multivariate main effect for the sustained attention factor was significant [$F(4,138)=2.9$, $p<.05$]; however, only spelling and reading produced significant univariate main effects. The high sustained attention group performed significantly better on these achievement variables.

A significant three-way multivariate interaction was obtained [$F(4,138)=2.8$, $p<.05$]; however, the univariate interaction was significant only for spelling and reading. These interactions are illustrated in Figures 1 and 2. In order to understand the three-way interactions, analyses of simple effects were carried out at each level of the three factors. Two significant multivariance two-way interactions were obtained.

The first one of these was between the successive and sustained attention factors for the high simultaneous group. This suggests that the students in the

high simultaneous category performed differentially on the achievement variables dependent upon the category of their successive and sustained attention factors. For this particular significant simple effect, only the spelling variable produced a reliable result [$F(1,70)=5.67$, $p<.05$] in the univariate analysis. The second significant multivariate interaction was observed between simultaneous and successive factors for the high attention group [$F(4,66)=3.10$, $p<.05$]. This suggests that the students in the high attention category performed differentially on the achievement variables dependent upon the category of their successive and simultaneous factors. However, the corresponding univariate results were significant only for the reading variable [$F(1,69)=3.89$, $p<.06$].

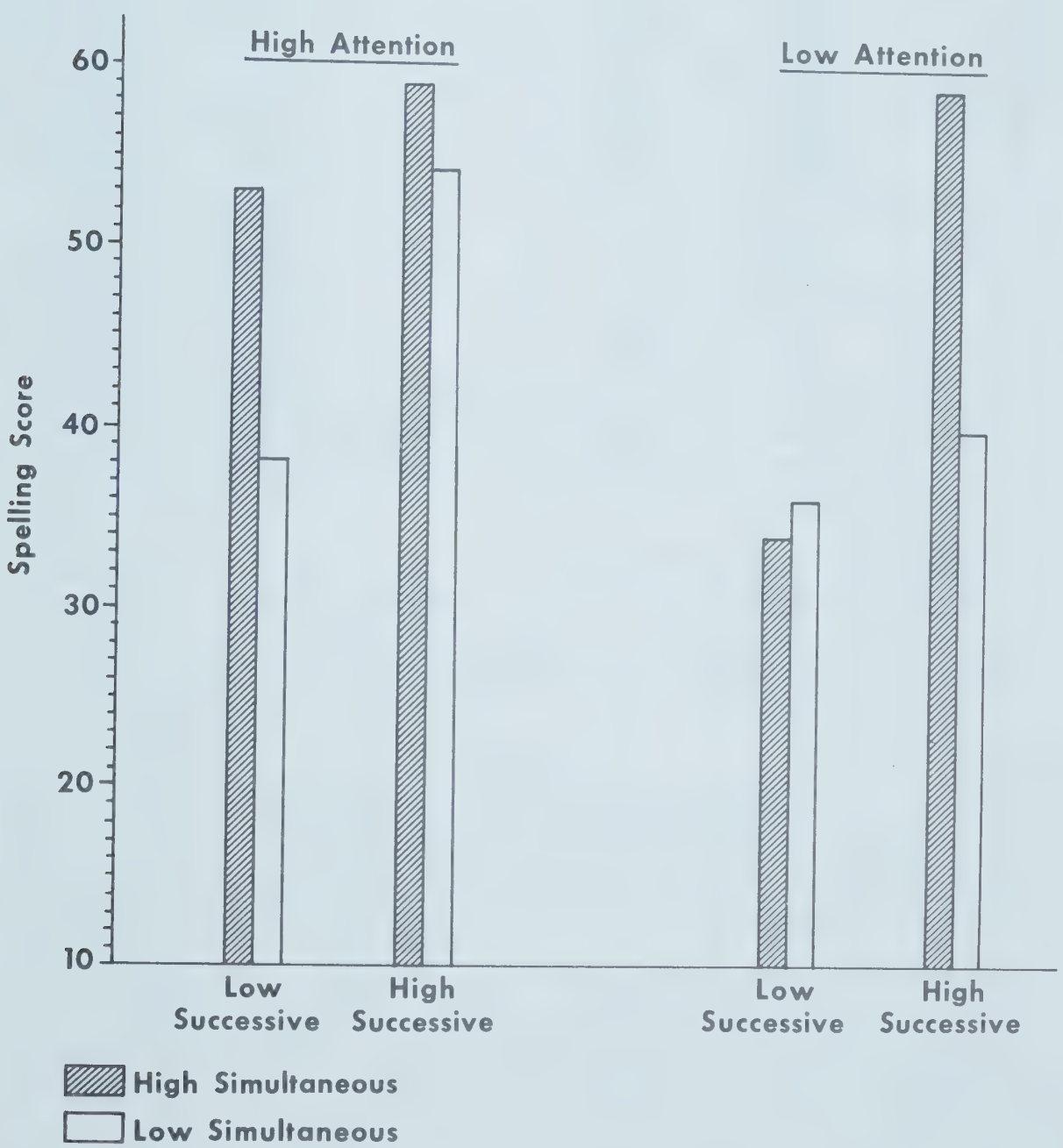


Figure 1. Three-way interaction for the spelling variable.

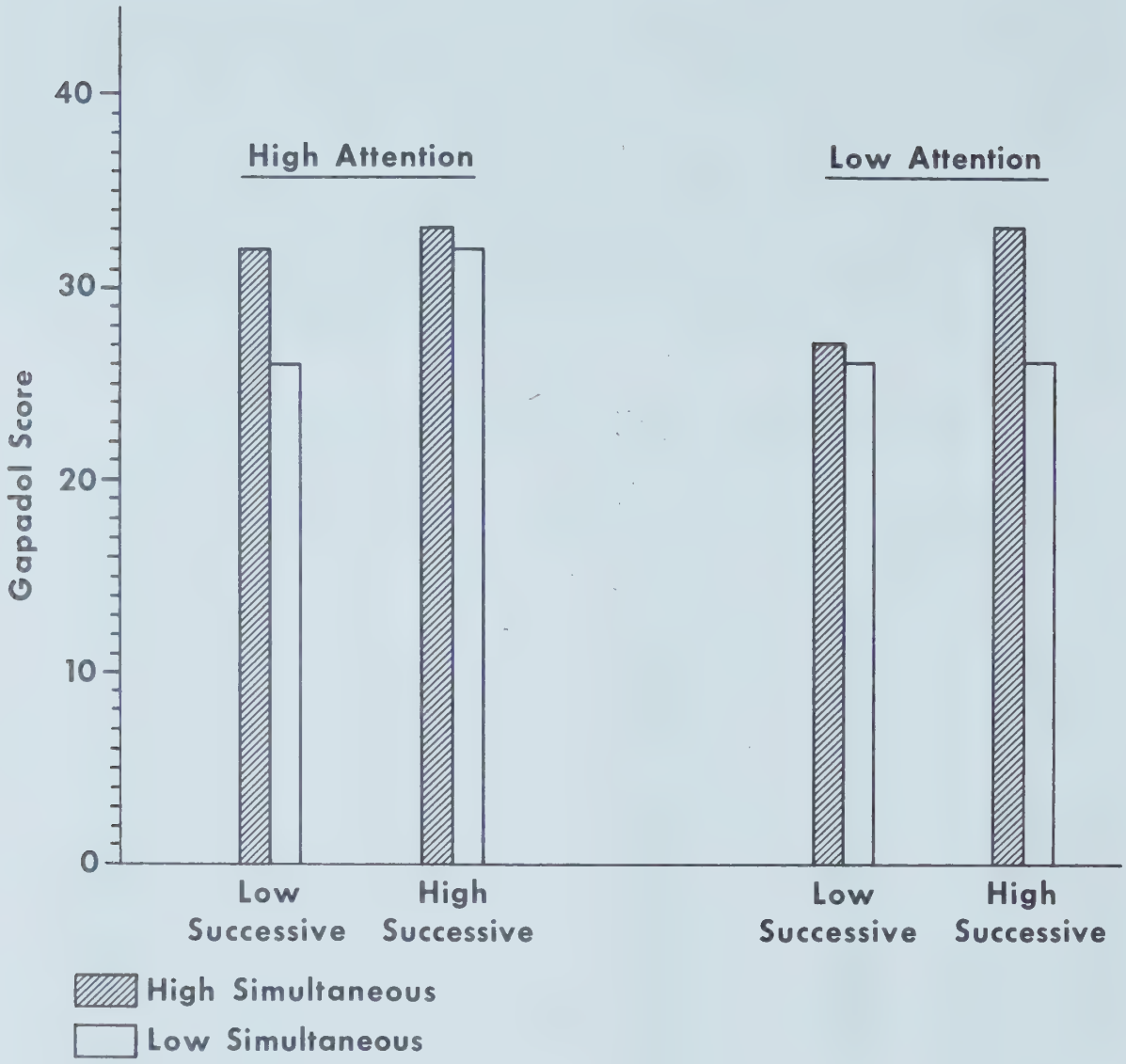


Figure 2. Three-way interaction for the reading variable.

TABLE 2
CORRELATIONS BETWEEN FACTOR SCORES
AND FOUR ACHIEVEMENT VARIABLES

| | Varimax Factor | | |
|---|---|---|---|
| | Successive | Simultaneous | Sustained Attention |
| Spelling | .39* | .27* | .35* |
| Math 1 | .31* | .40* | .10 |
| Math 2 | .22* | .36* | .07 |
| Reading | .27* | .30* | .40* |

* $p \leq .05$

The three-way interactions on achievement variables, more specifically reading and spelling, are further illustrated by the intercorrelations of factor scores and achievement variables given in Table 2. It can be seen that three-way interactions emerged only on those achievement variables, reading and spelling, which had significant correlations with the three factors.

*Discussion*

In both measures of mathematics, it would appear that those students who are high in both successive and simultaneous processing obtain highest scores and those who are low in both are the lowest, irrespective of whether they have a high or low measure of sustained attention. Similarly, irrespective of whether the measure for sustained attention is high or low, those sudents who are high in one mode of processing and low in the other score in between the two extreme groups. These results, using mathematics as a dependent variable, are similar to the results obtained by Kirby and Das (1977) using reading as a dependent variable. However, in the present study, the introduction of a measure of sustained attention significantly influenced the outcomes in reading and spelling.

It would appear that if students are high in both the simultaneous and successive categories, and if this is coupled with a high degree of sustained attention, then students obtain high scores in reading. However, if students are low in one of the successive or simultaneous categories, then whether they score high or low in reading depends upon whether they score high or low on the sustained attention factor. Individual differences in reading are dependent upon many factors. McClelland and Jackson (1978) summarize these factors and point out the importance of the general speed and efficiency of processing visual information as a required prerequisite for good reading. It is not surprising that in the present study a measure of sustained attention plays an interactive role in reading.

Similarly, the results suggest that if students are high in both sustained attention and successive processing, coupled with a high degree of simultaneous processing, then they obtain high scores in spelling. Similar to the results in reading, if students are low in one of the sustained attention or successive categories, then whether they score high or low in spelling depends upon whether they score high or low on the simultaneous factor.

One possible interpretation of these results would be that a conjoint high performance on two of the three factors is compensating for the low performance on any one of these. This compensation is probably a function of the programming unit. That is to say the programming unit may have developed differential ways of dealing with the inefficiency through the more proficient integration of the two efficient units.

The question could be asked why this is so for reading and spelling and not for mathematics. This is where the task demands have to be taken into account. Because arithmetic may be more dependent upon observing relationships in a more global way, then it would appear that sustained attention is not a determiner for success. The important determiner is the demand of the task itself. In spelling and reading, which are partly dependent upon preceding and subsequent cues, attention to detail is necessary and sustained attention plays a more important role.

Not only, then, is high achievement dependent upon the correct choice of the functioning units necessary for a specific task and the integration of these, but also dependent upon the best orchestration, which includes compensatory activities, of the units an individual has available for a particular task. These orchestrational activities that must originate in the programming unit may be the key to optimal success in dealing with cognitive tasks.

*Notes*

1. Paper presented at the American Educational Research Association Conference. Boston, April 1980.

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# Some Data and Reflections Upon the Quality of the Learning Process as Experienced by Third Year B.Ed. Generalist Students at the University of Alberta

*A twenty-item Likert-type questionnaire was administered to 180 students in the third year B.Ed. elementary generalist program at the University of Alberta in order to assess students' perceptions of their experience within the program. The practicum component was experienced positively, but students experienced some stress in handling the organization of the generalist program.*

In response to public and professional criticism, the Faculty of Education at the University of Alberta has instituted extensive revisions in its Bachelor of Education (B.Ed.) program for future teachers. The center piece of the changes is more practicum experience along with a highly structured configuration of courses and programs. The new programs with some exceptions (Vocational and Special Education) have resulted in a course concentration in the curriculum and instruction (CI) departments of the Faculty. Other departments, such as Educational Psychology, Educational Foundations, and Educational Administration tend to have less classroom contact with students as a result of the B.Ed. revisions. Students from the Faculty of Education tend to have less contact within and without the Faculty with other students and courses than previously as a result of the tight scheduling and program concentration.

The first term began on September 14, 1981, for B.Ed. generalist students with a CI "module" comprising four interrelated CI courses which

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continued until the fifth week (October 16, 1981). One grade was given for a student's performance based upon the mean of the four courses comprising the module. Phase II practicum began October 19, 1981, and continued for four weeks until November 13, 1981. The beginning of the last four weeks of the year (November 16 - December 11, 1981) saw the resumption of the CI module and the simultaneous beginning of courses in Educational Administration, Educational Foundations, and Educational Psychology. The CI module ended December 11, 1981 so there was no study break for final examinations in the module. Some students claim to have spent time on course assignments over the Christmas holiday for the three above courses in Administration, Foundations, and Psychology which resumed on January 11, 1982 and ended on February 22, 1982 (including final examinations). Practicum (Phase III) resumed on February 22, 1982 and continued until April 23, 1982.

As can be seen from above, the elevation of practicum experience to a place of emphasis has been accompanied by some changes in course scheduling practices within the Faculty. Courses run for 4, 6, 10, and 13 weeks, and span Christmas vacation by starting in the Fall and ending in the Spring. The concern for the effects of such scheduling upon the teaching-learning process led to the present research.

The present study arose in response to concerns from a number of students in the class, expressed to the first author, about the revised B.Ed. elementary generalist program. As instructor and student, the present authors determined to assess some of the ways in which students, within the Elementary strand of the revised B.Ed. program, were experiencing the effects of the above changes and whether the concerns of the above students were shared by their classmates. The point of the present study was not to compare the third year B.Ed. elementary generalist program with preceding programs but to explore the experience of students within the present program.

## *Method*

### *Subjects*

The subjects were enrolled in an Educational Psychology course in learning. All students in the third year B.Ed. elementary generalist program were enrolled in the class from which the present sample was drawn. There were 250 students in the class, 180 were present on the day the data were collected.

### *Procedure*

Students entering the program had completed an observational practicum in their first year (ED CI 251) and one participational practicum (ED CI 310) of four weeks at the beginning of the third year. Students had completed one of two complementary ED CI modules of four subjects (nine credits). The remaining module was to be completed during the third year. Modules included either Mathematics, Science, Art, and Movement or Reading, Language Arts, Music, and Social Studies. At the time the data were collected, students had just completed their second module and were about to enter the second phase of their third year practicum of four weeks.

The data were collected at this time before attendance declined as it often does as exams approach and students are preoccupied with exam preparation. Data collection was delayed in order to obtain the largest sample possible. Also,

data collection during the course was expected to tap the extant lived-experience of the students rather than their post hoc recollections.

A twenty-item Likert-type questionnaire (see Table 1) was administered to all students in the seventh week of a ten-week course which started November 12, 1981. Students were given the following instructions: Below you will find a number of statements relating to the third year of the B.Ed. generalist program. Please indicate on the answer sheet your degree of agreement or disagreement. The descriptors on the five-point scale were: strongly disagree, moderately disagree, neither agree nor disagree, moderately agree, strongly agree. Students responded anonymously on optical scoring sheets which were subsequently analyzed.

Previously, students had been asked to write a list of their concerns about the new B.Ed. program. These were collected by the second author and content analyzed to provide the topics for exploration in the present study. Items were developed directly from the student concerns. Some of the items were arranged to control a response set. If a respondent answered affirmatively to all items, nine of them would be critical of the program while eleven items would be supportive. The item presentation was randomly ordered.

### *Results and Discussion*

Table 1 shows the 20-item questionnaire and the percentage of respondents choosing each option for each item. Inspection of Table 1 shows that for most items the distribution of responses is markedly skewed with standard deviations ranging from 1.0 to 1.3. Skewness and relatively low variability characterize the responses to most items. Consequently for the sake of convenience, the "moderately" and "strongly" categories are combined in the data presentation. Particular item distributions are articulated in the course of the data presentation. The total percentage of responses for the "moderately" and "strongly" categories of agreement/disagreement are presented together with the breakdown of the percentages of responses in the respective categories. The composite sub-percentages are shown from left to right as they appear in Table 1. If the item involves agreement the category order is moderately, strongly. If the item involves disagreement the category order is strongly, moderately.

The vast majority of students (88%-11,77) perceived their practicum as a positive experience (item 11). Consequently, as might be expected, 77% (26,51) thought their cooperating teacher taught them a lot about teaching (item 12). A high percentage (82%-35,47) thought four weeks with one teacher was desirable (item 14). Many students (72%-22,50) also wanted additional practicum in the fourth year of their program (item 15). The modal response for the four items concerned with practicum was in the "strongly" category, suggesting a fairly clear indication of students' positive perceptions of their practicum experience.

The rectilinear distributions of responses to items 13 and 17 indicate that students have varied opinions about the adequacy of their preparation for student teaching. The specific reasons for their ambivalence warrant further investigation.

The policy of averaging marks in the CI module caused concern for 52% (19,33) of the students (item 9). Eighty-one per cent (27,54) of the students believed that averaging marks did not give them feedback about specific strengths and weaknesses in individual subject areas (item 10). The overall pattern of responses in these two items suggests that evaluation and feedback within the "module" was a greater concern for the students than the procedure of giving students an overall average mark.

TABLE I

RESPONSES TO THIRD YEAR GENERALIST B.ED. PROGRAM QUESTIONNAIRE

| | Score | | Response Category Percentage | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. | NR | 1 | 2 | 3 | 4 | 5 |
| 1. Splitting the CI module into two segments for Phase II of the practicum increased stress due to delayed performance assessment. | 3.8 | 1.3 | 0 | 10 | 7 | 14 | 31 | 37 |
| 2. Splitting the CI module into two segments for Phase II of the practicum disrupted the continuity of learning of CI methods. | 3.8 | 1.3 | 0 | 8 | 10 | 12 | 29 | 41 |
| 3. The four-week break between practicum segments necessitated additional review and stress. | 3.7 | 1.2 | 0 | 8 | 7 | 19 | 38 | 28 |
| 4. Attempting to cope simultaneously with review for CI module courses and student teaching and preparation was reasonable and non-stressful. | 2.3 | 1.2 | 1 | 32 | 29 | 18 | 15 | 6 |
| 5. Preparing for final exams in the CI module made it very difficult to attend to offerings in concurrently overlapping courses in Psychology, Administration, and Foundations. | 4.4 | 1.1 | 1 | 6 | 5 | 2 | 19 | 68 |
| 6. The interruption of the instruction of the CI courses with the practicum had no disruptive effect on the learning process. | 2.4 | 1.2 | 0 | 28 | 36 | 14 | 17 | 6 |
| 7. I would prefer to complete courses before being required to begin my student teaching or other course work. | 4.3 | 1.1 | 0 | 4 | 4 | 10 | 20 | 62 |
| 8. Writing final exams in the CI module while beginning new course work was stressful. | 4.4 | 1.0 | 0 | 4 | 3 | 6 | 22 | 65 |
| 9. The averaging of the marks in the CI module caused no concern for this student. | 2.6 | 1.5 | 0 | 33 | 19 | 14 | 17 | 17 |
| 10. The averaging of the marks in the CI module did not show my strengths and weaknesses in individual subject areas. | 4.2 | 1.2 | 0 | 7 | 4 | 8 | 27 | 54 |
| 11. I believe that the practicum experience was a positive learning experience. | 4.5 | 1.1 | 0 | 6 | 2 | 4 | 11 | 77 |
| 12. My cooperating teacher for the four-week practicum taught me a lot about teaching. | 4.0 | 1.3 | 0 | 10 | 6 | 7 | 26 | 51 |
| 13. I felt well-prepared for the student teaching phase of this degree. | 2.9 | 1.3 | 0 | 18 | 23 | 22 | 24 | 12 |
| 14. The four-week practicum with one cooperating teacher was desirable. | 4.2 | 1.0 | 0 | 3 | 6 | 9 | 35 | 47 |
| 15. I would like to have the opportunity to experience a practicum in the fourth year of the generalist program. | 4.1 | 1.2 | 1 | 6 | 3 | 19 | 22 | 50 |
| 16. The organization of the third year of the generalist program has provided a meaningful learning environment. | 2.1 | 1.1 | 0 | 38 | 27 | 22 | 9 | 3 |
| 17. I feel that I am well prepared to teach elementary school children in each of the subject reas. | 2.6 | 1.2 | 1 | 23 | 31 | 17 | 23 | 6 |
| 18. I believe that the generalist program is providing me with a well rounded education. | 2.9 | 1.2 | 0 | 17 | 20 | 28 | 29 | 6 |
| 19. I perceive an inconsistency between desirable educational theory and the organization of the generalist B.Ed. program. | 3.9 | 1.0 | 0 | 2 | 7 | 24 | 36 | 31 |
| 20. The meaningful fulfilment of course requirements requires more time than is presently available. | 3.9 | 1.1 | 0 | 3 | 8 | 18 | 31 | 39 |

*Note.* The failure of some item response categories to total 100% is a function of rounding category responses.

Responses to five items (1, 3, 4, 7, 8) suggests the extent of stress experienced by students as a function of the revised organization of the B.Ed. elementary generalist program. The splitting of the CI module was experienced as stressful by 68% (31,37) of students due to delayed performance assessment. A significant majority (66%-38,28) also found the four week break between practicum segments to be stressful. Students (61%-39,22) also found it difficult to cope simultaneously with practicum and academic requirements. The vast majority of students (82%-20,62) preferred to complete academic course requirements before beginning practicum. Most students (87%-22,65) found beginning new courses while writing

exams in others to be stressful. The modal response for the five items dealing with students' experience of the organizational changes of the new program was in the "strongly" category on four items and in the "moderately" category on the other item. Consequently, these data present a fairly strong statement of part on the students' experience.

The final group of items (2, 5, 6, 16, 18, 19, 20) deal with the nature of the learning process as experienced by elementary generalist students. Responses to items 2, 5 and 6 show that students perceived the organization of the third year elementary program to be a disruptive influence upon learning. The splitting of the CI module (item 2) was perceived as inhibiting the continuity of learning by 70% (29,41) of the students. Writing finals for CI module while simultaneously beginning new courses made it very difficult to attend to the new courses according to 87% (19,68) of the students (item 5). Some students commented that they didn't open a book for the new courses until the module exams were over. A smaller majority (64%-36,28) of students found the interspersing of the CI module with practicum to hamper their learning (item 6). In general, 65% (27,38) of the students (item 16) did not find the organization of the third year generalist programs to provide a meaningful learning environment. Students were equivocal as to whether the same program provided them with a well rounded education (item 18). A majority of students (67%-36,31) perceived an inconsistency between desirable educational theory and the organization of the B.Ed. elementary generalist program (item 19), while 70% (31,39) of them thought more time was needed to fulfill course requirements if optimum learning was to occur (item 20).

The modal response for the seven items dealing with students' perceptions of the quality of the learning process was in the "strongly" category on four items and the "moderately" category on two items. The responses to item 18 were distributed almost rectilinearly. These data present evidence of some students' dissatisfaction with the quality of the learning process they experienced. The wording of the items reflects the student concerns from which they were developed and may have tended to facilitate criticism rather than to encourage an impartial evaluation. Nevertheless, the data do reflect student opinions.

These data indicate some students' thoughts and feelings on a number of aspects of the B.Ed. elementary generalist program: The practicum is perceived and experienced positively. Students are ambivalent about the adequacy of their preparation to teach, as might be expected when they are engaging in a new activity. Students do not like the policy of averaging marks in the CI module. Students experience the current organization of the program as stressful. Students do not like overlapping courses and/or practicum. Students believe that the current organization of the program inhibits learning. Students perceive a discrepancy between pedagogy as professed and practised within the B.Ed. elementary generalist program.

Much of the difficulty experienced by students reflected in the above data is the result of logistical problems. In the course taught by the first author, from which the data were collected, rooms were assigned for 15 seminars in addition to lectures times for the first four weeks of the course before Christmas recess. After the Christmas break, all seminar and lecture rooms had to be changed because of the previously mentioned asynchrony of course scheduling. This added to the stress caused by usual scheduling problems such as nonexistent rooms and seminars scheduled in wrong locations. The instructor was also asked by the Elementary Education department not to schedule any examinations or

assignments during the first four weeks of the course due to students completing exams in the overlapping CI module. In effect, the course became a six-rather than a ten-week course in terms of assignments and exams. The midterm exam was cancelled causing more weight to be placed upon the final exam. Planning for the course had to be drastically revised.

The present data are relevant to the recent Report of the Committee to Evaluate the Extended Practicum Program at Alberta Universities (1981). The report stresses the importance of the integration of theory and practice within the whole teacher training process (e.g., pp. 9, 36, 39). The report also stresses the need for structure to ensure sound general education of teachers. However, the present data suggest that the structure inherent in the B.Ed. elementary generalist elementary program or its current operation may not facilitate the integration of theory and practice nor produce student perceptions of a good general educational experience. The present structure seems more reminiscent of the types of programs criticized in the report (p. 26). Further examination of the new B.Ed. elementary generalist program is needed in order to check the validity of the implications of the present data.

The organization of the B.Ed. elementary generalist program is so compartmentalized that it is difficult to integrate theory and practice. The report (p. 28) makes the point that "the duration of the practicum is of secondary importance to the quality of the linkages between students' experiences in the classroom and the content and methodology of their professional courses." The present data suggest that this linkage may be inhibited by compartmentalization in the B.Ed. elementary generalist program. The compartmentalization in the B.Ed. elementary generalist program has also made it more difficult to fulfill the suggestion in the report (p. 25) that close ties be maintained between university departments of education and other academic and professional departments within the university. The scheduling of the courses within the elementary generalist program is quite different to the course scheduling of other faculties.

Perhaps the central finding of this study is the considerable stress experienced by students. The data suggest that the existing organization of the B.Ed. elementary generalist program may be the principal cause of stress. The following suggestions may lead to a marked reduction in stress and a consequent improvement in students' perceptions of their experiences in the third year of the B.Ed. elementary generalist program: Reduce the amount of compartmentalization in favour of increased continuity by (a) adopting a thirteen week continuous practicum, (b) eliminating split modules, (c) eliminating overlapping courses and practica, (d) eliminating overlapping courses, and (e) standardizing the length of courses to thirteen weeks so that they are in synchrony with most other university courses.

Another set of alternatives to the above recommendations involves attempting to modify the existing organization in the following ways: (1) Try to reduce anxiety over impending practicum experience with increased attention to preparation for this experience. (2) Try to improve the integration of the university based instruction and the practica in order to facilitate continuity of experience. However, with over 250 students in the program, this may be very difficult. (3) Increase the emphasis upon integration within the module and increase the amount of feedback about student performance so that it is continuous and specific rather than terminal and general.

A third possibility is to turn the Faculty of Education into an autonomous school (e.g.,Teachers' College or Normal School) as a way of eliminating the problem of integrating courses and programs with the rest of the University.

The present authors favor the adoption of the first set of recommendations because they appear to be the most likely way of reducing student stress and improving the quality of the learning experience of third year B.Ed. elementary generalist students by facilitating integration of the program into the university as a whole.

There are also other possible combinations of the recommendations made here. For example, regardless of whether major organizational changes are made or not, the program can doubtlessly improve with greater attention to the integration of the module components. However, the present authors believe that the complex nature of the present organization, given existing numbers of students and limited faculty resources, is the major cause of the difficulties reported by students in these data. This intrinsic organizational problem of the program is not likely to be solved by fine tuning in subsequent years of the program's operation. Short-term adjustments such as more attention to integration of university and school based experiences may improve the program but not eliminate the inhibiting effect upon learning of the compartmentalization and overlapping reported in these data. We also believe that, regardless of how faculty or interested outsiders perceive the third year B.Ed. elementary generalist program, the value of the program is largely dependent upon the way it is experienced by the students who live through it.

The strong interest in a practicum experience in the fourth year of the program (item 15) is understandable in the light of the overwhelmingly positive responses of students to their third year practicum experience. The question of a fourth year practicum raises issues about the relative importance of university based and classroom based teacher training or more specifically, the relation of conceptual knowledge of subject matter content and teaching methods to classroom application. The appropriate degree of emphasis upon either of these two sides of teacher training and their meaningful integration warrants continuing consideration. Perhaps in the past, practicum experience has been understated; however, caution may be advisable in avoiding an overreaction resulting in the production of skilled teacher-technicians who are short on in-depth subject matter knowledge and higher order conceptual abilities. The degree of student ambivalence about whether they are receiving a well rounded education (item 18) supports this concern.

The data of this study are derived from students' perceptions of their lived experience within the third year of the B.Ed. elementary generalist program. The study focuses specifically upon this perspective. Whether the perceptions of instructors and teachers involved in the program are different from those of students remains an empirical question. Whether the students' perceptions are justified or not does not negate the reality of their having those perceptions. Sometimes there is a gap between the rationale and the projected understanding of educational planners and those who participate in the implementation of the plans. This study is part of the process of identifying the perceptions of major participants (students) in order to promote greater understanding. The personal involvement of the authors in the situation from which the data are drawn also needs to be borne in mind. The present study was not an attempt to evaluate the

B.Ed. elementary generalist program impartially but an attempt to assess the extent of student concerns which were spontaneously presented by some students to the first author. The items in the questionnaire reflect the ways in which, at least, some students were experiencing the program. Those data appear to suggest that the student perceptions which led to the study were shared by a considerable number of other students.

The present data also suggest the need to explore in more detail students' reservations about their preparation for student teaching in the third year and their reservations about their preparation in various subject areas. Further research may disclose whether student reservations about the elementary B.Ed. program are unique or comparable to reservations about other programs.

The most disturbing aspect of the revised third year B.Ed. elementary generalist program for the present authors is the doubtlessly unintended drift towards an apparent assembly line approach to teacher training reflected in the course organization. The experience of students reflected in the above data suggests a possible lack of sensitivity to the lived-experience of the student within the planning and implementation of the program. Learning is obviously more than a matter of interfacing students and resources. The learning process in a course requires considerably more time than the number of contact class hours in order to read, reflect, write, and engage in the ancilliary classroom activities that are a vital part of meaningful learning. We believe that the present data warrant serious reconsideration of the organization of the third year B.Ed. elementary generalist program with a view to reducing student stress and facilitating the integration and continuity of the learning process for teacher preparation.

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# PERSPECTIVES

## Education and Women's Work: Some New Research Directions

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The unequal position of women in the labour force is a cause for political concern and academic interest. We know that women earn about 60% of what men earn. Women are concentrated in a few occupations. One third of them are in clerical jobs; the rest are mostly in sales and service jobs and in teaching and nursing. Whatever they work at, women are more likely than men to be at the bottom end of the hierarchy of responsibility and power.

Educators, policy-makers, and sociologists have long investigated the ways in which schools help to produce the problems we see in the workplace. In this paper I will look at how we can understand the relation between school and work for women. I will argue that the research that has been done on this question has been very one sided, concentrating on documenting the differences men and women bring into the workplace — differences which are shaped by the schools. In this kind of research there is at least the implicit assumption that institutional processes are open and competitive, that people are able to choose among alternative options at school and work, and that employers accurately identify and equitably reward individual characteristics. But the amount of sexual segregation at work is much greater than the differences between males and females in achievement and personality. Our assumptions about how competition and choice are set up need to be carefully examined. We need to pay more attention to the ways the school and the workplace appraise, develop, and channel the skills and

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abilities of men and women instead of assuming a meritocratic process. We need to look at how these processes operate in different ways in different educational settings and segments of the labour market and not assume that the same processes occur everywhere.

*Research on individual differences*

The two research traditions which have been most important in establishing educational achievement as one of the principal determinants of an individual's position in the labour force are occupational status attainment research and human capital theory. Both concentrate on understanding how differences among individuals produce differences in their labour market experiences. Both then suggest that changes in individuals, particularly changes in their schooling, could change their experience in the labour market. Both traditions lead easily to the assumption that the problem for women lies in the schooling they have or do not have rather than in the structure of opportunity that they confront.

Occupational attainment research is a research technique rather than a fully developed theoretical model, although the technique implicitly makes various assumptions based in structural-functional theory (Horan, 1978). Researchers use various individual attributes such as parents' socioeconomic status, educational achievement, IQ, attitude measures, and the like to predict an individual's occupational achievement. Such attributes are measured on a unidimensional scale from high to low. Using these techniques, educational achievement has been found to be an important predictor of occupational achievement even though the amount of variance accounted for in any of the models is generally low (Jencks, 1972, 1979).

The status attainment model was developed for the most part on male populations. Blau & Duncan (1967), in their extremely influential book on occupational attainment in the U.S., dealt only with men, stating that

> men's careers occupy a dominant place in their lives today. . . a knowledge of the occupational structure and of the conditions that govern men's chances of achieving economic success by moving up in the occupational hierarchy is . . . essential for understanding modern society. (pp. 7-8)

Women are considered, but only as wives who might influence their husbands' careers. Women are not included in their own right because their careers were not considered important and/or because they did not easily fit the model. How does one determine the status of housewife and how does one deal with the time she may be out of the labour force? In the traditional model it is easier to omit them from consideration.

Human capital theory leads one to predict that an individual's educational achievement will be rewarded at work by an increase in income because more educated workers are more productive workers. Becker's (1964) human capital theory is not explicitly limited to men, as Blau and Duncan's work is. He discusses investment in "people" and "human" capital. However, it is clear that his data and theory apply more precisely to men than to women. In a section on women, he notes that income differences between well educated and less well educated women are smaller than these income differences are for men. This suggests human capital theory does not work as well for women as for men, employers are not prepared to pay them as much for their education. He deals with this difficulty first by suggesting that women might be experiencing an equal rate of

return to their investment in education, in any case, because the cost of their education is less if one takes into account forfeited income while in school. He finds that even this somewhat circular reasoning fails to make the lower rate of return for women disappear. He then suggests that a woman's husband's income should be treated as an income return to her education since she was able to marry a wealthier man by continuing her education. This helps, but "even when the gain from a more lucrative marriage is included, the money rate of return from college seems less for women" (p. 102).

Both the basic Blau and Duncan model of status attainment and Becker's notions of education as human capital retain their importance today in academic research and policy discussion. We tend to look at individuals' education in order to account for their position in the labour force. Attempts to include women in the analysis have increased as women's participation in the labour force has risen. But the models which were used to account for men's experience are of limited utility in trying to explain why women remain disadvantaged in the labour force. I suggest this means we need to take a second look at the models. Even when adjustments are made to include some extra variables in the old frameworks, these frameworks remain inadequate, as will be set out below.

*(a) Achievement differences*

Both status attainment models and human capital theory suggest that staying in school longer and doing well there should increase one's position in the labour force. Use of the model by researchers has led them to attribute the relatively lower status of women in the work force to lower school achievement.

The idea that women do relatively poorly in school is widespread. Byrne (1978) in her book on women in education refers to women as an "underachieving group" along with the working classes and rural children (p. 15). Finn, Reis and Dulberg (1980) state, "No matter how attainment is conceived, the one-sidedness of the issue is clear." In Canada, the Royal Commission report on the status of women (1970) emphasized that women were underrepresented in post secondary education, especially in graduate and professional programmes. A recent Economic Council of Canada discussion paper states that "Recent studies indicate that being a woman sharply reduces the probability of undertaking advanced studies, regardless of area of study. In fact, the higher the qualification the lower the proportion of women" (Boulet & Lavallee, 1981). Synge (1977) emphasizes the "relatively recent access of women to secondary and post-secondary education" (p. 298).

Much less attention has been paid to the evidence that girls do better than boys in public schools and that, on the average, women in the labour force are better educated than boys are. Girls read better, at least in North America, and reading is the basis for most school tasks. Boys are more likely to be in special classes for slow learners and to have learning deficits. Girls also progress faster than boys through school and are less likely to be above the modal age for their grade. Girls are more likely to stay in school until they graduate from high school (Perspective Canada, 1974; Maccoby & Jacklin, 1974).

Statistics on the educational attainment of the population show that women are overrepresented at the middle levels, which account for the largest percentage of the population, and are underrepresented at the low end. Women continue to be overrepresented among those with diplomas or certificates at the postsecondary

level even though they are underrepresented among those with university degrees. The educational levels of women in the labour force are higher still, relative to men's. Women in the labour force are less likely to have only elementary school education, and are more likely to have both high school and postsecondary education (Picot, 1980).

Women's overrepresentation in the high school has been a fact since records have been kept for public high schools. Boys dropped out of school earlier, so we find that in the U.S., girls were 58% of all public high school students in 1890, 57% in 1900, 56% in 1910, and 56% in 1920. The predominance of females is even more striking for high school graduations from 1890-1920 where over 60% were girls (Poss, 1981). In British Columbia, girls accounted for 63% of high school enrollments in 1900, 57% in 1920, 54% in 1940. (B.C. Public School Reports, 1900-1940). Robb and Spencer (1976) show that not until 1950 did the school attendance rates of 15-19 year old Canadian boys catch up to the girls'.

Women's participation in university education has increased rapidly. "In 1960-61, only one of every four bachelor's degrees was awarded to a woman. By 1980, women were earning one out of every two, and it is anticipated that in this decade female bachelor degree recipients will outnumber men by an increasing margin" (Zur-Muehlen, 1982, p. 5). The Anisef, Paasche and Turrittin (1980) study shows that girls in Ontario are more likely to go to community college than boys and that there is little difference in those going to university.

Women in the labour force have more education than men yet they are paid less for the work they do. Women earn far less than men for every year of education they complete, and the ratio of male to female earnings has not improved over time. Statistics Canada (1979) shows that women with a university degree earned $11,363.00 on the average in 1977 while men with a university degree earned $20,337.00. Women with some high school education earned $5,766.00 while men with equivalent education earned $12,085.00. Women with university degrees were earning, on the average less than men with only some high school education. The difference is true for the first year on the job as well as later years, so differences in performance and experience cannot account for the discrepancy.

Feathermen and Hauser (1976), using a regression model, found that the earnings benefit of an additional year of schooling was $279 for males and $81 for females in 1962. It increased to $406 for males and $180 for females in 1973. Though this constitutes a much larger percentage increase for females, the absolute dollar amount of the difference became larger over that period.

If the status of one's occupation is used as the dependent variable instead of income, the differences in returns are much smaller. The relationship between educational attainment and occupational status is as strong or stronger for women (Goyder & Pineo, 1973; Anisef et al., 1980; Featherman & Hauser, 1976), although there is some disadvantage for women with high educational achievement (Marsden, Harvey & Charner, 1975; Boyd, 1981). Status ratings are strongly influenced by the educational levels of people holding the jobs thus making the prediction of status by education a somewhat circular process. Moreover, using status as a measure of occupational success does not reveal the fact that women are disadvantaged in the workplace (Wolf & Fligstein, 1979). The occupational status distributions of men and women have similar means and standard deviations. Thus status measures are not very useful in telling us about processes that differentiate men's and women's occupational chances.

In sum, women's achievement in school is not, as is usually assumed, substantially lower than men's and cannot account for the lower economic rewards they experience at work. Staying in school has not meant getting ahead for women, at least relative to men. While an individual woman may improve her position relative to other women by staying in school, women as a group have not been able to turn superior educational achievement into superior economic rewards.

*(b) Differences in course choice*

If achievement itself is not the problem, some have suggested that it is the kind of education women get and the courses they choose that constitute the problem. Although we think of our schools as coeducational, there is an enormous amount of segregation by sex, starting in the secondary school where business education, industrial education, home economics, mathematics, and the physical sciences show substantial differences in course enrollments (Anisef, 1980; Scott, 1981; Gaskell, 1981). At Canadian community colleges, Devereaux and Rechnitzer (1980) show more than twice as many males as females in business and commerce, data processing, engineering, and primary industry programs. Females are equally overrepresented in social welfare, household sciences, general arts, education, nursing, secretarial science, and other medical and dental programmes. At the university in 1978-79, males were more likely to be in engineering (6%F), commerce (30%F), medicine (34%F), dentistry (18%F), architecture (25%F), forestry (21%F), law (34%F), religion (27%F), science (35%F); females were more likely to be in education (74%F), fine and applied arts (65%F), household science (98%F), and nursing (97%F) (Statistics Canada, 1980, p. 25).

The trends over time are for more equal representation of women at the university level, although similar trends cannot be established at the high school and community college. Female enrolment increased substantially over 5 years in every predominantly male faculty. It went up 13% in law, 10% in medicine, 15% in forestry, 10% in architecture and 4% (the lowest increase) in engineering (Statistics Canada, 1980). The organization of community college programs has changed so rapidly in the last 10 years that comparisons over time would be difficult to do reliably. Moreover, enrolment figures from Statistics Canada are not broken down in a way that displays sex segregation easily. In the high school, enrolment data are also hard to come by and show no clear shift to more equal representation by sex (Gaskell, 1981a, 1983).

Course enrolment shapes skills and interests and develops a sense of competence and familiarity with different areas of experience. It influences choices about work and affects the ability of students to get different kinds of work and to get into programmes of further study. Background in mathematics, physics, and computer science is an increasingly critical filter affecting vocational training and job prospects.

However, course choice still leaves a good deal of unexplained variability in the labour market returns to education for men and women. Even when the kind of education women get is taken into account, they do not get income returns to their courses that are equal to men's. Anisef (1980) shows the males graduating from the high school academic program earn $3,000 more than women graduating from the same program. In commercial courses, the gap is $2,300 and in technical and vocational courses, $2,000. The gender gap is least for graduates of the industrial

programs. Young women enrolling in industrial courses make $1,400 more than the young women graduating from the academic program, and almost $3,000 more than the young women from the commercial program. Schooling can help a girl, relative to other girls, but it is not effective in overcoming group differences between males and females.

Statistics Canada (1980b) and Devereaux and Rechnitzer (1980) report similar data for community college graduates. In every case, the males graduating from a course make more money than the females graduating from the same course. For two-year diploma graduates, the difference is $5,000: $4,000 in general arts and science, about $3,000 in primary industry, $3,000 in applied sciences, community services and business management, $2,000 in trades and crafts, and engineering — and so on. Taking medical and dental services or computer science raised women's salaries most relative to other women's.

The same survey reports income data for university graduates by field of study. The sex differences in earnings ranged from about $100 in pharmacy and the fine and applied arts to $1,000 - $2,000 in education, engineering, history, and law, to $6,000 in medicine and dentistry. Women in engineering and education earned the highest salaries of any women graduates. A recent U.S. multivariate analysis of income returns to university education showed that taking major field of study into account reduced the gap between male and female income returns "only slightly" (Angle & Weissman, 1981).

If we turn from income to occupation, the returns to taking nontraditional courses also seem to be lower for women. Having taken a "male" course, they are less likely to get a "male" job. There is a good deal of research showing a low relationship between field of training and type of job (Little, 1970; Wilms, 1974; Pincus, 1980). The reasons for a low relationship are varied. An educational credential provides the possibility of work in an area but does not guarantee a position. Other factors such as personal contacts, personality, and discrimination remain important — often more important than education (Granovetter, 1974; Levinson, 1975). The match between the number of graduates in any field and the number of jobs in the field is not perfect. Employers often do not demand a close fit between training and the job, assuming much can be learned on the job as long as the "right sort of person" is hired.

Even women who do enter broad or atypical fields of training tend to get jobs in traditionally female areas. In the community college, women with business diplomas get clerical jobs; men with business diplomas get managerial positions (Devereaux & Rechnitzer, 1980). At university, the type of course a woman selects decreases the likelihood of her doing clerical work, but only in medical and technical areas does it reduce it below 1%. More women than men enter teaching from every field of study at the university, except French. Men who get a teaching certificate are more likely to be employed in higher paying jobs not related to education (Devereaux & Rechnitzer, 1980). The tendency for women to revert to traditional jobs increases as time since graduation increases (Bielby, 1978).

In sum, the differences between the courses men and women select while they are in school can only partially explain differences in their experience in the labour force. Attention to these differences leaves unexplained why programmes that are predominantly female systematically lead to lower paying jobs. It leaves unexplained why women in predominantly male programs do not get jobs that are equal to the jobs their male counterparts get.

A related problem should be pointed out here. Research on sex differences in course enrolments tends to explain the differences in enrolments by looking at differences among individuals choosing the courses. This is the same model I have been examining in relation to the labour market and some comments of a similar nature can be made. Individual differences do not constitute a complete explanation of differences in course enrolments. They constitute a partial explanation, one that avoids examining the structure within which "choices" are made.

The emphasis in course selection research has been on why girls tend to select traditionally female programs. Ability differences have been considered although ability differences are so much smaller than differences in course selection that they can only account for a very small part of the variance (Robb & Spencer, 1976; Kimball, 1981). Differences between males and females in anxiety levels, personality traits, and interests are explored (Parsons, in press; Fox, 1981). The explanations are always partial. As one would expect, all sorts of girls choose, for example, nursing courses or secretarial courses. As Herzog and Bachman (1982) suggest, "young people who plan on similar occupations share few common values" (p. 159). If a pattern emerges in nontraditional areas, it is what Alice Rossi (1965) has called a pioneer, an unusual woman who can take on the difficult job of being in a minority in a male field (Rezler, 1967; Walshok, 1981). In other words, girls going into male fields may need qualities that are different from the qualities required by men in those fields. Researchers cannot assume females and males with the same characteristics will fare equally well. In order to understand this, we need to explore how the situation is different for girls, and how we might make the programs as safe for mediocre girls as they are for mediocre boys. This involves a change from looking at individuals to looking at institutional arrangements.

Course choices are often produced by job choices. Whatever her anxiety about mathematics, a girl who wants to be a nurse will take it if she needs it to get certified (Parsons, in press). Recent research shows very little closing of the gap between males and females in high schools since 1964 with respect to their occupational preferences (Lueptow, 1981; Herzog, 1982). Choices of traditionally female occupations remain sex-typed as do those for skilled blue collar occupations. Females are becoming somewhat more likely to choose male white collar occupations. But as an explanation of course choice, this takes us back to the same dilemma. Job choice can be explained with reference to girls' interests, abilities, and ideas, or with reference to the institutional structures that confront them. Plans are not based only on preferences, but also on what is deemed acceptable and feasible in today's world of work. Thus young women may have already modified their plans in line with what they perceive to be occupational careers open to women (Lueptow, 1981).

*(c) Differences in socialization at school*

Attempts to rework status attainment models to account for women's experiences have added on variables that had not been considered important for men. As Alexander and Eckland (1974) conclude in their comparison of male and female data, "It is quite clear that the educationally relevant variables examined here. . . do not account for the sex liability in the data. The model must be expanded to include factors not typically included in the study of males. This might involve the addition of marriage and fertility variables, sex role specific

attitudes" (see also Boyd, 1981; Sokoloff, 1980). Research in this tradition then bends the model to account for women's experience, but continues to focus on what it is about women (their attitudes, their marital status, their labour force participation) that produces problems for them in the labour force.

Much of the research on women in schools has explored how schools are agents of sex role socialization through which girls develop attitudes, interests and social behaviors that cause problems for them in the labour market. Whatever theory of socialization one accepts, there is evidence that the process of gender socialization is continued in the school (Richer, 1979). Traditional views of what is appropriate for women are taught through the "hidden" curriculum as well as through the official curriculum. Books and media used in the schools either omit women or portray them in traditionally stereotyped roles (Fisher & Cheyne, 1977). The everyday life of children in schools is permeated with stereotyped ideas about male and female roles (Delamont, 1980). Teachers interact more frequently with boys and allocate tasks according to traditional notions of male and female interests (Russell, 1979; Clarricoates, 1981).

This research has alerted teachers to discriminatory practices and continues to be an important influence in bringing about a more egalitarian school system. It directs our attention to the ideological context in which we learn to think about gender and shows how young women and young men come to think about their future in the labour market in different ways. However, there are several problems in examining only how schools produce traditional sex role beliefs and in relying on sex role socialization to explain adult gender differences.

What girls learn in school is at least more complicated and less consistent than all the emphasis on traditional roles suggests. It could be argued that school is less likely to reward traditional femininity than many homes and workplaces are. More educated women tend to be less traditional in their opinions on gender issues (Gibbins, Ponting & Symons, 1978). Formal school processes are similar for both sexes and teachers tend to be well educated women who have more liberal opinions than most other groups in the society. Little research has been done to look at both the liberating and the traditional messages in schools. Feminists have, understandably, been much more interested in the latter and have tended to assume that these traditional messages are successfully inculcated into young girls. Anyon (1981) has pointed out, however, that many girls resist and fail to incorporate these messages. Girls are also exposed to the dominant values of achievement and success and can bend and adapt notions of femininity to their own needs. Our usual models of socialization have assumed too much passivity on the part of girls growing up.

Secondly, the literature on stereotyping emphasizes the way the stereotype produces underachievement in women. Horner's (1970) work on the motive to avoid success is probably the best known in this area, but many others have argued that femininity encourages a girl to pretend she does not know much and so to lower her aspirations to be intellectually passive. As Levy (1972) concludes, "masculine characteristics are related to intellectual development and self actualization, whereas the strong, consistent pressures on girls to be feminine and good pupils promote characteristics that inhibit achievement and suppress females' full development" (p. 1).

It could also be argued, however, that much of the female stereotype encourages social competence and enhances their achievement in school (Wine,

Moses & Smye, 1978). The negative valuation of things that are female leads to some bizarre consequences, common in the literature, such as prizing aggression, associated with males, and devaluing sociability, which is associated with females. Traits which are female are treated as causing low achievement while male traits are used to "explain" male success. The necessary relation is not so clear. When women do achieve, this achievement is devalued as conformity or doing what they are told. We need to look not only at how ideology depresses women's achievement but also at how it may explain the fact that women have by and large done very well in school. Its effects are more ambiguous than we have noticed. Instead of exploring only how schooling teaches girls characteristics that reflect their jobs in the labour force, we should also consider that schooling might teach girls social competencies that are in contradiction to their position at work.

Adding sex role beliefs into an occupational attainment model does help to predict expectations of labour force behaviour (Gaskell, 1977) and labour force participation (Smith-Lovin & Teckamyer, 1978). However, the effect is not very large. This is quite consistent with social psychological research on attitudes and behavior, which suggests that attitudes often do not predict behavior since there will be situational forces working for and against behavioral realization of attitudes (Acock & DeFleur, 1972; Andrews & Kandel, 1979). This will be true particularly of general attitudes such as sex role beliefs and of attitudes that develop in school before the actual contingencies of family life and the work force become real.

Moreover, attitudes towards work and femininity are responsive to events in the "real world" rather than being static attributes of the individual. Much of the behavior that is explained by women's acceptance of traditional ideology can also be explained by the effects of the opportunity structures they face. Robb and Spencer (1976), for example, conclude that it is quite rational for women not to invest in higher education given the low economic returns they can expect. Madden (1978) similarly shows how economic returns can predict women's educational decisions. Similarly, deciding to stay at home with children may reflect a paucity of real options for child care. We do not need to assume that women are "brainwashed" by traditional attitudes.

To summarize, in this section I have looked at ways that research has focused on what women bring into the labour market from the schools, particularly on what is different from and inferior to what men bring into the labour market from the schools. Women bring in different levels of achievement in school, different kinds of achievement in school, and socialization that has rewarded different traits and beliefs. But what women learn need not be seen as inferior to what men learn. And these differences may be a result as much as a cause of an unequal job structure. Focussing exclusively on sex differences tends to overemphasize the traditional, sexist nature of schools and produces an incomplete explanation of how schooling is involved in maintaining sex differences in the labour market. Working with this model has led researchers to look only for those differences in school that correspond to differences in the adult labour force. Contradictions and weak links have been glossed over. If a different model of the adult labour market is adopted, however, so that we do not assume that what is learned in school will cause what happens in the labour market, it is possible to look more squarely at the various aspects of what happens in schools.

*Research on the structure of labour markets and their implications for education and training*

Status attainment models and human capital theory assume an open, fully competitive labour market in which individual characteristics are identified and rewarded equitably. They assume the average worker in the average workplace and see what effects changes in education will have on this worker. They assume that the important difference among jobs is in the level of rewards they provide but that there are no significant differences in the way they attract and treat labour since all employers attempt to maximize profit.

Criticism of these models and their assumptions has been appearing with increasing frequency (Edwards, Reich & Gordon, 1975; Horan, 1978; Stolzenberg, 1978; Hodson & Kaufman, 1982). The notion of labour market segmentation is used to focus attention instead on differences among workplaces in their demand for and use of labour. Workers are allocated to labour markets and thus to workplaces through a variety of practices which classify workers on criteria which may be marginally related to their ability to perform the job. We know that information is not always accurate or perfectly communicated. Rigidities and discriminatory practices exist. What are desirable traits for one employer may be less important to the next, and school achievement may or may not be important.

Once workers enter a particular workplace, their careers will depend not just on their individual characteristics but on the structure of opportunities that are available there and on what has been called the structure of internal labour markets. Some firms provide fewer opportunities for mobility than others. Similar traits are rewarded differently in different firms and in different occupations. On-the-job training is only sometimes available.

Segmentation analysis suggests new ways to study the relationship between education and training and work. Education can be analyzed as part of the process of sorting and classifying workers and structuring labour markets. The relative importance of educational qualifications and of abilities and attitudes developed in the school can be examined for various kinds of workplaces and employers. But to do this, we need to turn to economic models which are not familiar in educational research. We also need to pay more attention to historical work on how the links between education and work were forged and how the particular structure of schools and their provisions for access to jobs were developed.

Segmentation analysis is particularly important for understanding women's experience in the labour force, as women by and large do different jobs from those of men. Women are heavily concentrated in a few occupations which employ mostly women — clerical, sales, service, and a few semi-professional jobs such as teaching and nursing. They are more likely than men to be employed in secondary jobs — i.e. in small, marginal firms. This occupational segregation by sex is very resilient, cannot be explained by individual characteristics, and shows few signs of declining (Gross, 1968; Armstrong & Armstrong, 1978). The characteristics of women's jobs can explain much about women's behavior in the labour market and vice versa.

There are two important characteristics of the jobs women do that help us explain the low economic returns women experience to their schooling. First, as Oppenheimer (1970) has pointed out, women's jobs systematically underpay for the years of education they demand. The roots of this can be traced historically. That women can be paid less than men was an established tradition before

industrialization and it was carried over with the support of employers and male workers into the new jobs women came to do (Hartman, 1976). Women moved into jobs that were expanding rapidly while funds to pay for the work were expanding less rapidly. The organization of training can reinforce low pay by providing a plentiful supply of qualified workers. While shortages will provide pressure to increase the wage, an oversupply allows low wages to be paid. Training for women's work has been lodged in the public schools more often than training for men's work. It is thus more accessible and will provide a larger supply of workers than training that is subject to higher entrance requirements or employer or union sponsorship.

Secondly, the jobs that women do provide few opportunities for on-the-job training, requiring instead extensive training before employment (Wolf & Rosenfeld, 1978). Clerical work and the semi-professions (nursing, teaching, librarianship, etc.) all have this character. The jobs women hold in small marginal firms and in the clerical, sales and service areas tend to have less chances for on-the-job training and promotion than the jobs men hold.

Canada Manpower Statistics (Statistics Canada, 1980a) show both the under-representation of women in on-the-job training and the segregation of women into particular kinds of on-the-job training. Women constitute only 27% of all trainees, these being concentrated in stenographic and clerical trades and inservice occupations, particularly medical and health services. Statistics on other forms of on-the-job training which are not subsidized by the government would undoubtedly reveal these patterns even more strongly.

The examination of these patterns raises a number of new questions and areas for educational research and suggests new explanations of why women get the kind of education they do and why it does not help them much in the workplace. The organization of vocational training as it is presently structured must not be taken for granted but requires an historical and dynamic analysis of why it takes the shape it does and why it changes in relation to the organization of the workplace. Why does women's vocational training tend to take place in the public school system, while training for jobs men hold takes place on the job? What changes might be made in the structure of work and schooling? These questions focus not on women themselves as the problem but on the structure of education and work as it has been and is still negotiated between employers, government and educators.

*Some starting points in the investigation of the training of women*

Research on the structure of training for women's work is not as well known as the research discussed in the first part of this paper. There is also not as much of it. In this section, I will begin to draw on some of it to suggest the directions in which more research should proceed and the questions that I have found provocative and unanswered. It should be clear that this is only a beginning; as more research along these lines takes place, the shape of an alternative approach will become clearer.

The organization and development of the high school curriculum is one area to explore. Katherine Poss (1981) has suggested that the public high school was originally set up to provide job preparation for women. "Up through the 1880's, a major function of the high school was to provide the public elementary schools with female teachers." Then, starting in the late 19th Century the public high

school began to provide commercial education. Thus the public high school was providing a solid vocational preparation for girls, while the links between education and a young man's future were much more tenuous.

Commercial education has remained the one area of the high school curriculum that prepares students directly for jobs, despite the introduction of more vocational courses for boys (Gaskell, 1981). A girl who graduates from them acquires typing and shorthand skills which cannot be picked up on the job and which are likely to be tested before she can get the job. Girls who take commercial courses do better in the labour market than girls who do not take the courses (Nolfi, 1978; Gaskell, 1981b).

The industrial courses which appear to be the equivalent courses for males are not as closely linked to work. They do not provide credentials or skills that are tested or expected on entry to jobs. The student who has taken carpentry is not a carpenter. The student who has taken auto mechanics is not a mechanic. Trades training takes place after high school, usually while a worker is being paid, and research suggests it is boys in the academic programme rather than in the industrial program who will be preferred because of their higher status (Nolfi, 1978; Little, 1970). There have been some recent attempts to introduce pre-apprenticeship programs into the high school, but proposals to create alternatives to apprenticeships at the community college or to subsidize employers to provide the training on the job remain more popular.

Our usual assumption that the difference in the location and organization of training is due to the nature and difficulty of the tasks is at most only a partial explanation. Clerical work is less expensive to start in schools. However, expensive machines exist in school shops and experience in settings outside the school is used in commercial courses and could be used in others. We must monitor the impact of the increasingly expensive computer equipment that is being introduced into offices.

One might argue, to use Becker's (1964) typology, that clerical skills are "general" skills that can be transported from one employer to another while industrial skills are "specific" and of use only in a particular firm. While it would be economically rational for an employer to train for skills that are firm-specific, it would not make sense for him to provide general training as he would be subsidizing other employers who do not engage in this kind of training. The state would then have to step in to provide general training.

But commercial courses provide more than general skills. They go beyond teaching typing to include office-specific machines, practices, and work simulations. Many of the skills taught in the commercial courses do not apply widely in the job market. Many of the machines used in schools are not used in offices; the particular letter format that is learned by a girl in school may well not apply to the office in which she works. Moreover, recent attention to industrial skills has pointed out that there are many generic skills that are useful in a wide variety of industrial settings (Smith, 1975). Employers' reluctance to hire and train apprentices is often phrased in terms of the general nature of the skills that are learned and the fact that other employers quickly attempt to hire trained workers (Ministry of College and Universities, 1973; Harvey, 1980).

Not just the technology and skills but the social organization of clerical work and the fact that women did the work had an important influence on how its training took place. The power of women as workers is one issue. While male

unions had some success in restricting the supply of skilled workers through apprenticeships and negotiated contracts (Palmer, 1979; Rule, 1981) women were unable to do the same thing and large numbers of teachers and clerical workers were trained in the public school system.

The reluctance of employers to invest in women is another issue. Thurow (1975) has argued that employers will minimize investing in groups "known" to have a low attachment to the labour force. The longer an employee stays with a firm, the longer the period over which the firm can receive returns on its investment. Women are seen as short term employees likely to stop work and return to the home. If a man threatens to change jobs, "The employer will at least have the opportunity to bribe the employee to stay. Such countervailing bribes would be less effective in stopping women from having children" (p. 178). As there is no assumption that women will stay and take much responsibility in the firm there is less necessity to control their training and more willingness to trust public schools to do at least an adequate job. These assumptions need not be true to be influential. The form of training that has developed becomes a self-fulfilling prophecy encouraging intermittent work histories because the jobs provide for no long term careers.

In clerical work, therefore, the rapidly expanding demand for cheap labour, the reluctance of employers to invest in on-the-job training for women, and the feminization and lack of unionization of clerical work all contributed to its emergence as part of the high school curriculum (Dunn, 1979). Unions concerned about restricting the supply of labour and employers willing to invest in men prevented this from happening to the trades, whatever vocational courses were added to the curriculum.

The development and organization of vocational training at the community college requires a similar kind of analysis of a process that continues to unfold. The rapid increase in courses at the community college level suggests that training for a variety of jobs is getting changed from a relatively informal process of on-the-job learning supervised and paid for by the employer to a formal credit course at a public institution under the supervision of specialized teachers. Educational requirements for jobs are becoming more standardized and rationalized. Although this process may reduce labour costs and increase profits as some have claimed (Pincus, 1980), it is taking place more in some areas than others. The increasing representation of women at community colleges suggests that it may be "women's work" that is particularly subject to this kind of reorganization and upgrading of pre-entry educational requirements. For example, child care programmes, which tend to be overwhelmingly female, have been instituted. Associations of child care workers have lobbied for the recognition of their training by day care centres and for the exclusion of anyone who does not have formal credentials from teaching at a day care centre. The success of this attempt to "upgrade" the work will depend on a variety of factors in the marketplace: the organization of funding, the supply of workers, the way work gets reorganized, the political power of the occupational group, the use of new technology, and so on (Wein, 1979). These are the same factors that affected the organization of clerical and industrial courses in high schools. At the same time, the areas where community colleges do not develop and expand courses need to be examined. Either unions or employers or both may want to restrict the supply of labour, keep it unskilled or exercise more control over the selection of students and the content of their training than public institutions allow.

At the university, the same relations can be investigated. The organization of university courses in relation to the labour market is different in different areas. In many professional and semi-professional areas the degree obtained is necessary in order to work in the area, for example, in education, medicine, architecture, and law. This relationship has become stronger over time in some areas. For example, in teaching it used to be common to be able to teach without a university certificate. These days it is not. In other areas, the dominance of professional qualifications is questionable. Graduates in engineering and commerce are employed in a wide variety of areas and may compete with arts graduates for the same job (Ahamed, Greenberg, Desroches, Mitchener, Cartier & Brown, 1979).

Relations between university training and professional work develop and change over time, reflecting the power of the professional group to control the supply of labour. Collins (1979) provides an account of how doctors and lawyers were able to control access to their occupations, excluding midwives and barber-surgeons for example, through the nature of the training process. Engineers were less successful at controlling training processes. We can assume that women have had less power to insist on a formal and long credentialling process for the jobs that they do.

Looking at the structure of training will partially explain both how much and what kind of education women get. If they can get skilled jobs in offices with a high school education they will complete high school but be less likely to go on to higher education than if these jobs rewarded higher educational levels. If taking business courses in high school provides them with job skills they cannot get elsewhere, they are likely to opt for the business courses rather than the industrial or academic ones. If entrance into nursing training requires grade 12 science and mathematics, girls wanting to be nurses will try them.

The structure of training will also partially explain changes in women's access to nontraditional job areas and higher paying occupations. A long training program may discourage some women who do not plan to stay in the labour force for a long time and thus reduce their access to jobs they have traditionally held. For instance, using the child care example, women who used to be qualified because they had brought up children would now have to return to school or be relegated to a lower paid job ghetto made up of informal babysitting in the home. On the other hand, a formal educational program may increase the attention paid to ability and open recruitment more widely so that women have more access to nontraditional jobs. As has been pointed out, women do relatively well at school and have tended to stay there longer than men. They are overrepresented as students at the community college level. Increased training may increase women's wages by upgrading the quality of their labour and decreasing its supply. On the other hand, public training programs may open training opportunities more widely and devalue them.

Many of these questions remain open and need further research. We must pay more attention to them. It is not enough to concentrate on what women are like and what they choose in order to understand the relation between their education and their work. We must look at the organization of education in the areas that women work, and see how the organization of jobs produces particular patterns of labour force activity and school attendance. Changes in the organization of work and training, not just changes in women themselves, are necessary to increase the economic position of women. Occupational segregation by sex must be diminished. Jobs where women predominate need to be reorganized to include more on-the-job

training and more potential job ladders. These changes in work can have an impact on women's economic returns to education, on the educational decisions women make, and on the organization of public schooling.

*Concluding observations*

I have argued that research on women in schools needs to focus more on the structure of vocational preparation for women and to examine the reasons that women are unable to translate their educational achievements into success in the labour market. This would represent a shift in emphasis from research on the inferiority of women's schooling and on their socialization into traditional roles. As I have argued, this shift can be justified partly because existing research cannot account fully for what we see in the labour force, and partly because it is based in theoretical assumptions that are too simplistic.

However, the political and ideological implications of such a shift also need to be considered. Research on what is wrong with women's achievement or ideology tends to do what Ryan (1971) has called "blaming the victim" — locating "the stigma, the defect, the fatal difference — though derived in the past from environmental forces — within the victim" (p. 7). This kind of analysis is congruent with basically liberal notions of equality of opportunity — that anyone can make it if they are intelligent and try hard — and with psychological notions of development — that early experience is critical in determining later achievement. But these notions are fundamentally conservative (McPherson, 1965; Kagan, 1978) and should not provide the only way of framing research questions. They lead to, as Ryan notes, "a perverse form of social action designed to change, not society, as one might expect, but rather society's victim" (p. 7). For women they lead to strategies to give girls more information about the labour market, to have them consider nontraditional careers, to reduce their mathematics anxiety and so on, but not to strategies to change the structure of opportunity women confront.

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# Linking Educational Research and Educational Policy Via Policy-Relevant Research

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At present, policy research seems to exist in two quite different forms. In the first, it tends to be a sub-category of evaluation research or, more generally, of traditional social science research, and is carried on by academic researchers with the results published in the normal journals. It is this form of policy research which James Coleman describes in some detail in *Policy Research in the Social Sciences* (1972b). It concerns itself with the *impact* of policies and, according to Coleman, can take two forms, input/output studies of the Equality of Educational Opportunity (1966) type, or preferably social audit studies which trace the flow of resources, focussing on their diversion from intended recipients.

In the second form, policy "research" typically consists of a debate (formal or discontinuous) in which various parties advocate various solutions to a policy problem, often without any thorough statement of the issue or any careful attempt to identify a range of feasible alternative solutions. The policy adopted is generally a function of who happens to be in the appropriate place at the time (often unannounced) for a final decision. Such research, conducted largely by the policy-makers themselves, in fact produces the vast majority of the policies which guide our various social enterprises, from universities to lotteries. There are a number of exceptions, in which typically some academic researchers are gathered together in a centre to conduct policy research. In Canada the Alberta Human Resources Research Council during its life span provided an excellent example (see Housego, 1978). The Hudson Institute or the Rand Corporation provide examples from the United States. There are also some self-conscious attempts to use general social science research findings in decision-making (see, e.g., Egnatoff, 1978). But there are probably thousands of public policy decisions made every

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day, in school board meetings, in local government, state, provincial and federal agencies, in Crown corporations, in universities, and elsewhere which conform to the definition of research given above.

The lack of useful communication (see, e.g., Caplan, Morrison, & Stanbaugh, 1975) between these "two communities" of policy researchers helps to account for the failure to use research findings (Rich, 1979, p. 7), and is clearly disadvantageous to the societies served by the policy process and the resulting social programs. Although an enormous amount of money is spent in research and development activity, particularly in the United States (Cohen & Garet, 1975, estimate two hundred million dollars annually on education alone), there is still little systematically verified knowledge about how to maximize the utility of research in policy-making. At present we are seeing the results of a number of efforts to apply research methods to this problem. A recent study by Mitchell (1980) adopted what seems to be a particularly productive approach to the issue.

Using data from interviews with 160 legislators in three western states, Mitchell first identified phases in the policy-making process and the subsequently linked social science research utilization to each of the phases. The four distinct phases in policy development in state legislatures are: *articulation*, turning diffuse demands into specific proposals for legislation; *aggregation*, pooling similar interest to support a particular policy or building consensus; *allocation*, accepting and adopting a particular policy statement; and *oversight*, the subsequent review of the impact of a particular policy. It is our contention that not only do each of these phases have different research needs, but that these needs require different types of research. We will argue that the needs of the articulation and oversight phases are being served to some extent by current research efforts, but that the needs of the aggregation and allocation phases which constitute the heart of the policy making process are not.

In order to serve the needs of the aggregation and allocation phases, research must emphasize policy concerns throughout the process of problem formulation, data collection, and interpretation. In this paper such a research model is proposed. It describes the characteristics of this form of research, which the authors have labelled Policy-Relevant Research (PRR), its relationship to public policy-making as this process is analysed by Mitchell (1980), and its relationship to other forms of social science research, from the perspective of utility to policy-makers. This model of policy-relevant research was developed from analysis of an evaluation study which the authors had undertaken and with which they felt some dissatisfaction. Thus it is necessary to provide, first, a brief description of the study and its findings and, second, a critique of the study as a piece of policy research.

### *A Follow-up Study of the Opinions of High School Graduates*

The evaluation study was intended to provide information to school district policy-makers regarding the opinions of recent graduates of the district about their school experiences in the various secondary schools. An Advisory Committee of district staff monitored the project closely, and many of the basic decisions were taken in committee. The entire population from three recent graduating years — 1975, 1977, and 1979 — was surveyed. This was intended to reduce the unreliability resulting from low return rates in a random sample. Of 2919 survey forms mailed out, 929 (32%) were returned, a common enough figure for large

surveys of graduates of high schools (Smedley & Olsen, 1975). To support the survey data, telephone interviews with a stratified random sample of graduates were conducted.

Three different student profiles, or configurations of characteristics, emerged from the interviews. The first profile was provided by students who, while in school, had planned to proceed to university studies; in every case their choice of university program was influenced by the high school courses they enjoyed and in which they did well. Further, their assessment of various school experiences was based almost entirely on how well these experiences prepared them for university study. Their assessments were generally positive. The second profile was provided by students who planned a specific kind of employment, with or without further non-university training. Their assessments of their school experiences were essentially similar to those of the first group, both in being based on the utility of school experiences as preparation and in their generally positive tone. The third profile was provided by students who had no idea, while in school, of what they were going to do after school, and is quite different from the other two profiles. Their school experiences had little meaning for them and they tended to be cynical, bitter, and negative about every aspect of schooling.

The initial analysis of the survey data used year of graduation and school as the independent variables. These did reveal some significant associations, notably in differences between schools, but the interview data caused the investigators to reanalyze the survey data, using certainty of career plans as the independent variable.

The questionnaire data established that certainty of postschool plans was significantly related to attitude towards school. For example, nearly all the high certainty respondents graduated, whereas over 10% of the low certainty respondents were school-leavers, almost twice the nongraduation rate in the district. Furthermore, a significantly larger percentage of high certainty respondents expressed positive attitudes towards various aspects of their high school experience than did low certainty respondents. For example, 78% of the high certainty respondents rated teachers favourably, compared to 64% of the low certainty respondents. The corresponding figures for high school experience in general were 72% and 53%; for variety of career, vocational, or business courses, 70% and 47%; for quality of academic courses, 69% and 62%; and for quality of career, vocational, or business courses, 54% and 38%.

The interview data helped to explain the nature of the relationship between certainty of postschool plans and attitude towards school. The respondents who had at least a general idea of what they wished to do after leaving school had a basis on which to select courses. They viewed many of their courses as a preparation for what they intended to do later and, not surprisingly, found them to be relevant and meaningful. In other words, having postschool plans was a major contributing factor to positive attitudes towards school. The picture presented by the low certainty respondents was precisely the opposite. Not knowing what they wanted to do after leaving school, they had no reason for selecting one course over another, they could see little utility for the future in what they were doing in school, and thus they felt dissatisfied and even bitter.

Given that certainty of postschool plans does contribute to positive attitudes towards school, the question facing policy-makers is how best to help students develop career plans. A significantly larger percentage of high certainty

respondents rated as helpful various influences on the planning of their careers than did low certainty respondents. The figures for teachers, counsellors, guidance classes, and family members were, respectively: 47% to 21%, 29% to 14%, 26% to 15%, and 73% and 62%. Again, the interview data helped to interpret these findings. The high certainty respondents did not rate either the counsellors or the guidance classes as helpful, but they did not expect them to be. The major influences on the career plans of high certainty graduates were their family and nonschool experiences. They tended to turn to counsellors only for specific information. Also, they described teachers as helpful influences, but mainly in the refinement and directing of initial plans rather than in their formulation. The low certainty respondents, on the other hand, needed help in developing career plans. They did not feel that they were given the help they needed, and this also contributed to their dissatisfaction.

Taken together, the two types of data supported the following major conclusion of the study:

> Student intentions or purposes are extremely important determinants of the student's experience in school: students who have a goal, particularly one which involves post-secondary study, are unlikely to drop out, are very likely to find high school teachers and courses relevant and satisfying, and generally rate their high school experience quite positively. Students without a clear-cut goal are not helped to develop one by the schools, and are more likely to drop out and to have negative perceptions about everything about the school, including especially the guidance program. (Coleman & LaRocque, 1981, p. 32)

The major policy implication of the study emerged from this conclusion. A revised role for high school counsellors and for guidance classes, in which early identification of goal-less students and very intensive career planning work with these students was made the major responsibility of counsellors was recommended. It was concluded that "a reduction in the number of students without career goals would, it seems likely, reduce the number of dropouts, and increase student satisfaction with the secondary school" (Coleman & LaRocque, 1981, p. 33) of the school district, certainly a desirable policy objective.

After completing the study, the writers experienced some dissatisfaction with it as a piece of policy research. In order to be policy-relevant, the research should have been concerned with causality, with the complexity of the problem and the setting in which it exists, and with utility, that is, the possibility of policy-makers acting on the findings and recommendations. When the study is examined from each of these three aspects, it may be judged somewhat satisfactory in the first case, but less so in the latter two.

With regard to causality, three features of the study contributed independent but corroborative evidence about the relationship between postschool plans and student satisfaction.

First, the use of both survey data and interview data allowed causal rather than simply associational inferences to be drawn, and in particular suggested a reanalysis of the survey data which would probably not have been considered without the clues provided by the interview data. In fact, it probably would have been preferable to have used interviews to seek possible causal associations, which would then have been investigated in a more carefully designed survey, reversing the actual sequence in this study. In general, the use of both survey and interview illustrates the point made by Cook and Reichardt (1979) on the utility of using features from both qualitative and quantitative research paradigms.

Second, the use of three cross-sections (1975, 1977, 1979), while not providing the quality of data of the properly longitudinal study (see Smedley & Olsen, 1975, on the merits of follow-through rather than follow-up studies of graduates), made it clear that student opinions of schools were relatively stable, which allowed the inference that the schools were not changing very much. More importantly it showed that the variable of student plans was of continuing importance, and not simply a temporary feature of a single student cohort.

The focus upon the plan-less students in the reanalysis of the initial data, rather than the majority of students, constitutes a focus on exceptions rather than norms. Most studies of student opinion have suggested that 80% of students have generally positive feelings about schools and have concerned themselves with the sources of these positive feelings, when they have been analytical at all. (See, for example, Jackson's review of a long tradition of such studies, 1968.) In this instance, the exceptions do indeed reveal more about causality than do the satisfied students: the link between career plans and student satisfaction is not found in previous studies, at least not as a major predictor.

With regard to complexity, the study was less satisfactory. Previous research on graduates has focused on a number of traditional items, including the contribution of various school factors, like teachers or programs, to satisfaction, and the reasons for leaving school without graduating. These studies were used to generate items for the survey, and the results did reaffirm, for instance, the positive way in which students perceive teachers, particularly teachers who demonstrate commitment. The question arises, however, of whether there were other, more important factors which affect student satisfaction. A reversal of the sequence of the study, with interviews preceding the construction of the survey, would certainly have allowed the identification of a number of different variables with a more careful multivariate analysis being possible.

Similarly, interviews with students still in school, and some further investigation of the school settings and the work of counsellors, at present, would have provided confirming or disconfirming evidence for the conclusion of the study that certainty of post high school plans was a major variable affecting every aspect of the students' school experience. Both these steps would have contributed also to providing a more carefully formative analysis of factors influencing student perception.

Finally, with regard to utility, the assessment of the study is mixed. On the one hand, the recommendations did focus on one variable, certainty of student plans, which is to some extent manipulable by the policy-makers. On the other hand, although the study was concerned with utility, and from the beginning dealt with an Advisory Committee of district staff in the hope that this would contribute to the eventual use of the results of the study, the overall utility of the study is still in doubt because receipt of the report was resisted by school district authorities at higher levels in the hierarchy than members of the Advisory Committee. The findings revealed a persistent pattern of differential effectiveness between high schools, reflecting negatively on some educators in some schools. Although the report provides at least one major suggestion for improving schools, it is not likely to be seen by significant policy makers in the district because of the negative findings. Thus, the researchers were insufficiently thoughtful about the political environment, and the final report should have been written differently if utility of the data was a prime concern. In the final analysis the

report approximated a traditional evaluation study of a school district, rather than a piece of policy relevant research, because of this failure of political sensitivity.

## *Policy-Relevant Research*

In order for research findings to be utilized during the aggregation and allocation stages, that is, to be policy-relevant, research should be addressed specifically to policy-makers, should investigate problems which are of concern to them, and should be designed to provide data and interpretations which have predictive utility concerning the probable consequences of policy options. Furthermore, PRR should concern itself with those policy options which are important to policy-makers, because they are normatively acceptable and have some face validity as solutions to the perceived problems.

Based on analyses of the follow-up study we would argue for the utility, during the decision-making phases of policy-making, of a particular form of research which we have labelled policy-relevant research. Unlike typical evaluation research it is explicitly intended to help decision-makers influence the future by providing relevant and reliable predictive generalizations. Its central concerns are causality, the complexity and multivariate nature of events in naturalistic settings, and utility, as the following characterization of PRR demonstrates.

1. Policy-relevant research should be concerned with causality rather than association and, hence, should:
   a. be longitudinal to allow for the manipulation of variables, either deliberately or through "natural experiments," in the search for causality, and to allow temporary variations in relationships to disappear (see Bronfenbrenner, 1975, on long-term studies, including Project Follow Through):
   b. employ both qualitative and quantitative techniques with the qualitative data guiding the collection and interpretation of the quantitative data (Cook & Reichardt, 1979); and
   c. focus on exceptions as often as regularities because exceptions can be more revealing about causality. See, for example, the research on over- and underachieving schools, the "outliers" in traditional evaluation research (Wilder, 1977), or on over- and underachieving students (Asbury, 1974).
2. Policy-relevant research should assume complexity, that is,
   a. assume that relationships in education are multivariate, with large effects from any single variable being rare and threshold effects and curvilinear relationships being as or more common than linear ones (see, e.g. Centra & Potter, 1980);
   b. be concerned with naturalistic settings and analyses which preserve the holistic quality of the setting (e.g., *Life in Classrooms*, Jackson, 1968; *The Man in the Principal's Office*, Wolcott, 1973); and
   c. make frequent use of measures and designs which reveal the contribution of various factors to outcomes, rather than of designs intended to demonstrate discrepancies, such as those between outcomes and objectives (see, e.g., Cain & Hollister, 1972, on outcome evaluation via discrepancies).

3. Additionally, policy-relevant research should be concerned with utility at every stage of the research, rather than addressing this in a postscript on policy implications, and hence should:
   a. focus on variables manipulable by policy-makers rather than simply on statistically significant variables (see Levin's use, 1970, of data from the Coleman Report, 1966); and
   b. be sensitive to the political environment and to uses likely to be made of the research findings (Sroufe, 1977).

These suggestions, particularly with reference to the concern with causality, are not novel, and certainly do not dispose of the issue. However, the deliberate adoption of the strategies suggested here at the planning stage of the inquiry will, we believe, provide much better informed interpretations of quantitative data and their significance than are otherwise possible.

The mood of uncertainty and uneasiness about the political uses made of the results of program evaluations in the 1970s, already described, has resulted in suggestions for change in research methodologies. For example, Rist (1981) argues for qualitative research rather than quantitative research as a better way of isolating the "levers of change" available to policy-makers.

> Quantitative research frequently emphasizes a form of "hit and run" social science whereby pre- and post-tests become the basis for not only conclusions about treatment effects, but about policy implications as well. This approach is increasingly coming to be seen as only marginally useful at best and outright dangerous at worst. Having little or no idea about what worked or why, but only that relations were statistically significant is not a particularly informative contribution to the needs of the policy-maker. (p. 490)

Another suggestion, made from an evaluation research perspective, focusses on strengthening the causal links which sometimes coexist with significant associations. Scriven's Modus Operandi (MO) method for maximizing the power of causal investigations is essentially the inverse of the logical process typically identified as rational policy-making (see, e.g., Anderson, 1971). The problem Scriven addresses is the identification of cause or causes of a particular phenomenon. The MO method, common amongst practitioners such as automobile mechanics, coroners, and toxicologists, is to construct a "quasi-exhaustive causal list," as inclusive as possible since "the cost of extra length in the causal list is minor, and the gains may be large" (Scriven, 1976, p. 108).

In policy development, the causal list is represented by the set of alternative policies, as exhaustive as possible given the limitations of the analyst and of his information (Lindblom, 1968). As with Scriven's MO, the causal connection is crucial because policies are instruments of social control and sometimes also of social change. The purpose is not "understanding" but "input." The main utility of predictive research, which maximizes the chances of selecting the most appropriate alternative, and hence of implementing successful programs, would be to minimize the social waste represented both by unsuccessful programs and by evaluations of these.

### *The Policy Process*

Keeping in mind this description of policy-relevant research, let us consider the research needs of the four phases of the policy-making process which were identified by Mitchell (1980) and how well these needs are served by traditional social science research and by evaluation research.

*Articulation Phase — Enlightenment Function*

The role of research findings during the articulation phase is to define and clarify policy problems. This is accomplished by providing "otherwise disparate, unorganized, and potentially conflicting individuals or groups with a common frame of reference or universe of discourse for interpreting a policy problem and identifying proposed solutions" and by influencing "the intellectual conception of a policy problem" (Mitchell, 1980, p. 12).

This function of research findings is derived from Weiss' description of the utilization of social science research by policy-makers based on three recent studies. She discusses the unifying function of providing a "common language of discourse" (1977a, p. 17), but she emphasizes the indirect, long-term, cumulative effects of social science research findings which are felt in policy-makers' conceptualizations of the problems and in their understanding of the issues:

> Research provides the intellectual background of concepts, orientations, and empirical generalizations that inform policy. As new concepts and data emerge, their gradual cumulative effect can be to change the conventions policy-makers abide by and to reorder the goals and priorities of the practical policy world. (1977b, p. 544)

A second major contribution of social science research generally has been argued by Rist (1981). He maintains that one important function of research is to provide "specific, manageable, and amenable definitions of the issue. If the issue is interpreted as one beyond the range of alternatives open to the policy-maker, response then becomes one of avoiding the issue or placing the blame elsewhere" (p. 487).

Traditional social science research then seems to have two most important contributions to make to the articulation phase of the policy-making process: first, it establishes goals and priorities for policy makers by establishing a common set of concepts and orientations, and second, it helps a great deal in defining and delineating issues with precision.

*Oversight Phase: Mobilization of Criticism Function*

Evaluation researchers, particularly program evaluators, have come late to the realization that their work has political implications, Sroufe (1977) points out that the paradigms used in the study of politics and those used in evaluation have the effect of keeping the two fields clearly segregated. However, his view is that "formal evaluation is an inherently political process and in some instances it has even greater policy consequences than do board or bond elections" (p. 287).

Evaluators are becoming disillusioned about evaluation and its use. For example, Williams & Evans (1972) conclude

> We recognize the danger that the results of evaluation and systematic testing can be ill-used. But what course of action is not dangerous? What "good" approach cannot be turned to evil? Is it not even more hazardous to proceed boldly — as if we know when we do not? . . . As we pose these questions, we trail often to grey areas of nagging doubts, without a burst of penetrating truth. This seems fitting — for to stand unsurely in a morass of conflicting issues simply mirrors the larger reality of today. (p. 264)

In part this disillusionment is a consequence of finding that the political uses of evaluations are almost always negative. Mitchell, in his study of state legislators, found that, although only a minority of policy-makers were active during the oversight phase, those who were active showed an intense desire for

data which provided "clear and unequivocal answers to questions about whether or not a particular program is 'working'" (1980, p. 1). This is very similar to the function ascribed to evaluation research findings by Wergin (1976) and Williams (1972). It was the legislative actors, not pleased with the program, who displayed this interest in evaluation studies, because they wanted to have convincing evidence to support their negative judgments. Weiss (1973) and Sroufe (1977) have also discussed the utilization of evaluation data to support a particular position concerning the continuation or termination of a program.

Despite all of the current concerns with evaluation and its political significance, the oversight phase of policy making is at least potentially well served by evaluation research which becomes more explicitly political, that is to say, is conducted by evaluators who are clear about the political purposes likely to be served by their work. In particular, policy evaluators need "to note with special attention interests of those parties that will have greatest voice in the policy, and interests of those parties that can directly exert pressure on the controlling parties" (Coleman, 1972b, p. 15).

*Aggregation & Allocation Phases: Problem-solving & Evidence Assessment*

During the aggregation stage, policy-makers look to research findings as a means of determining the facts and resolving specific issues in the search for feasible policy options. Proponents of particular positions attempt to create a "coalition of support," one tool at their disposal being the use of research findings to neutralize the objections of opponents and to persuade them of the merits of their position. At this point persuasion can be characterized as an "open give-and-take, collaborative process" (Mitchell, 1980, p. 15), but during the allocation phase there is a shift towards debate winning as commitment to one position strengthens. Consequently the policy-makers must assess the evidence provided by research findings in order to establish probable cause-effect linkages, on which are based predictions concerning the probable outcomes of various policy options, and to use this information as political ammunition to discredit their opponents and to reinforce their supporters. Neither social science nor evaluation research typically fulfill these conditions (see Table 1).

Social science research is addressed to the academic community, and its purpose is to add to the organized body of knowledge of a discipline. This is true both of the naturalistic and the rationalistic paradigms. Such research is not directed towards problem-solving, and Weiss (1977a, 1977b) has argued that it should not be, that the more appropriate role for social science research findings in the policy-making process is that of illumination and enlightenment. Similarly, Cohen and Garet (1975) believe that "reseach helps to shape policy climates" (p. 25) and "applied research resembles a discourse about social reality — a debate about social problems and their solutions" (p. 42).

Evaluation research, on the other hand, may be considered a type of policy-relevant research, although its role in the policy-making process is quite restricted. It is addressed to policy-makers, and its purpose is to provide data which are "relevant to the judgment of the worth of a social program or its components" (Wergin, 1976, p. 75). Such data may provide important feedback about previous policy decisions. They tend to focus on assessment of the outcomes of a policy decision rather than on the prediction of the consequences of policy proposals, however, and this limits their utility during the aggregation and allocation phases of the policy-making process.

TABLE 1
COMPARISON OF SOCIAL SCIENCE, EVALUATION,
AND POLICY-REVEVANT RESEARCH

| CHARACTERISTICS | SOCIAL SCIENCE RESEARCH | | EVALUATION RESEARCH | POLICY-RELEVANT RESEARCH |
|---|---|---|---|---|
| | Naturalistic Paradigm | Rationalistic Paradigm | | |
| intended audience | academic community | academic community | policy-makers | policy-makers |
| political sensitivity | little or none | little or none | increasing | high |
| purpose | increase knowledge | increase knowledge | judge program worth | guide policy decisions |
| function in policy-making process | illumination & enlightenment | illumination & enlightenment | performance evaluation & mobilization of criticism | problem-solving, evidence assessment, and outcome prediction |
| phase of policy-making process | articulation | articulation | oversight | aggregation & allocation |
| causality | does x cause y in a natural setting? | does x cause y? | to what extent did manipulating x cause y? | how can x be manipulated to cause y under naturally occurring conditions? |
| setting | natural | laboratory | natural | natural |
| nature of variables studied | significant in the natural setting | theoretically and/or statistically significant | significant in terms of the goals of the policy being evaluated | contribute to educational outcomes & manipulable by policy-makers |
| nature of truth statements | context-related "working hypotheses" which focus on exceptions as well as regularities | enduring context-free generalizations which focus on regularities | focuses on discrepancies between goals and outcomes | context-related "working hypotheses" which focus on exceptions as well as regularities |
| study duration and approach | extended period; formative | generally "one-shot"; summative | generally "one-shot"; summative | longitudinal; formative |

Note: Some of the characteristics of social science research, especially the distinctions between the naturalistic and rationalistic paradigms, are based on Guba & Lincoln (1981, p. 57 & 65). Evaluation research can also be either naturalistic or rationalistic.

Thus another form of research is required to serve the needs of the aggregation and allocation phases. The proposed model of policy-relevant research would serve these needs.

### *The Utility of PRR*

The great debate currently in progress, both in the United States and Canada, concerning the utility of social science research in improving public policy has raised a variety of issues. With regard to education, the focus has been on two concerns, (1) increasing the effective utilization of evaluation reports (see, e.g., Alkin, Daillak & White, 1979; Braskamp & Brown, 1980) and (2) political issues. These include the general disenchantment with government intervention, based on a neo-conservative critique (Wirt, 1980); the breakup of the coalition of interest groups which won massive funding increases for education in the 1970s (Guthrie, 1981); and the lack of political sophistication of evaluators (Sroufe, 1977).

No doubt there are major truths in this literature. But some, at least, of the failures of policy research have been implicit in models used in conducting the research. In particular, evaluators come very late to the understanding that "evaluators should adopt a more collaborative role, involving the decision-maker and the staff in decisions about the evaluation" (Dickey, 1980, p. 76). By comparison, program implementers seem far ahead. (See, e.g., the review of research on the implementation of change by Fullan & Pomfret, 1977.)

Throughout this discussion, Policy Relevant Research has been described as an "approach" to research, focusing on prediction, so as to be useful in the policy aggregation and allocation phases rather than in earlier or later phases of the policy process as described by Mitchell (1980). In Table 1, an attempt is made to describe the relationship of PRR to existing research models and paradigms. But it is possible that PRR is itself a research model, independent of others, which contains a characteristic set of variables in stable relationships. These can be verbally summarized thus: the research model assumes complexity, seeks causal relationships in order to make predictions with at least modest levels of probability, and therefore suggests manipulable variables to be used by policy-makers seeking alternative ways of optimizing the attainment of policy objectives. These features can be summarized thus: Policy-Relevant Research

1. *assumes (seeks) complexity*, by carrying out multivariate analyses of data, collected in a variety of ways in naturalistic settings, and by anticipating multiple minor effects on outcomes, rather than a single major cause; and
2. *maximizes causal inquiry* by preferring longitudinal designs using both quantitative and qualitative paradigms and frequently focussing on exceptions rather than norms.

Such research expects to

3. *have utility for policy-makers* by identifying manipulable variables which, within political constraints, assist policy-makers to attain their objectives more efficiently.

The case study and the characteristics of policy-relevant research described here are an attempt to show that a modest shift in approach to conducting policy research could have significant effects. The set of characteristics is probably not exhaustive, and several of these characteristics appear in descriptions of qualitative techniques. However, the approach or model has both utility and integrity: we believe that a review of a broad range of research studies, intended

to be policy-relevant but failing in that intent, would show some deficiency in one of the PRR characteristics which predictably, according to our model, would limit or destroy the utility of the study. We would argue that *all* of the characteristics must be present in some degree.

For example, Williams & Evans (1972) report at length on the Headstart Program and its evaluation, perhaps the best-known and expensive failure in a policy initiative in the history of U.S. education. Yet the evaluation was itself flawed; a subsequent longitudinal study suggests that Headstart was in fact quite successful (Lazar, 1979). Similar illustrations could be provided of failures to take into account, in supposedly policy-relevant discussions, the multivariate nature of relationships in schooling (see e.g., Harnischfeger & Wiley, 1976, and Erickson's critique, 1976), the importance of naturalistic settings, and so on.

Research studies and analyses of existing research findings carried out in accordance with the PRR model are more likely, we believe, to be convincing and useful to policy-makers than the products of traditional research, or evaluation research, conducted according to either the rationalistic or naturalistic paradigms presently in use. However, for this to occur, it is necessary for policy researchers to be much more conscious of the policy development process, and the stage(s) their work is intended to serve. Until modes of research become differentiated, and explicitly purposeful, concerns about the failures of policy-makers to "use" research will continue at their current high level.

*Notes*

1. We use policy-*relevant* research to denote research serving the aggregation and allocation stages. Coleman (1972b) and others have preempted "policy research" to denote research on the *impact* of policy, i.e., serving the oversight phase.

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# BOOK REVIEW

CRITICAL THINKING AND EDUCATION. *By John E. McPeck.* Toronto: Oxford University Press, 1981, 170 pp.

Much of the writing that passes for Philosophy today might bring to mind the conversation between Alice and Humpty Dumpty in Lewis Carrol's *Through the Looking Glass.*

> "When I use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean neither more nor less."
> "The question is," said Alice, "whether you can make words mean so many different things."
> "The question is," said Humpty Dumpty, "which is to be master — that's all."

The endless and often tedious quibbling about the meaning of individual words or phrases is the main preoccupation of much Philosophical Analysis. John McPeck's *Critical Thinking and Education* is in some ways reminiscent of the conversation cited above, but in McPeck there are some very noticeable differences. Roughly one-half of John McPeck's *Critical Thinking and Education* is devoted to showing how the definitions of Critical Thinking offered by other philosophers are either inadequate or flatly wrong. However McPeck's book is a very rare and powerful example of why this process is both necessary and at times extremely useful.

McPeck has written a short yet highly informative and provocative book on the nature of critical thinking and its place in the process of education. This book is worthwhile and enjoyable to read because it actually advances the reader's understanding of the term critical thinking while offering strong evidence for the validity and usefulness of philosophical analysis as a legitimate approach to educational problems.

The strength of McPeck's position is to be found in his definition of critical thinking and the way in which it differs from others that are presently in use. Critical Thinking is, for McPeck, "the propensity and skill to engage in an activity with reflective skepticism" (p. 8). At first glance this appears to be a disarmingly simple straightforward definition of this term but, as McPeck's book indicates, it is a very complex term which is widely misunderstood.

Unlike many other analytical philosophers, McPeck does not view critical thinking as a set of skills or the ability to detect logical inconsistencies in propositional statements. He convincingly argues that critical thinking cannot be taught apart from specific subject matter. McPeck's position is that critical thinking can only be demonstrated in reference to a particular subject.

> The analysis of critical thinking provided here make it abundantly clear that it can only be taught as part of a specific subject and never in isolation. Indeed the very idea of teaching critical thinking in isolation from specific content is incoherent. (p. 158)

There are many courses taught in universities and faculties of education in particular which claim to teach students to think critically, but for McPeck these types of claims are essentially fallacious for they are based upon a false notion of what critical thinking is. Becoming a critical thinker is not simply learning to utilize the tools of logic or verify or analyze statements that are made. Rather, critical thought becomes a possibility only after the individual has mastered the basic or foundational ideas of a particular subject. He or she is then in a position to think critically about a particular subject because the individual knows the subject matter well enough to affirm or deny the validity of the basic assumptions that constitute that particular subject. Critical thought, for McPeck, is based upon and is an extension out of a solid knowledge of a particular set of ideas or concepts. We cannot, for McPeck, think critically until we can think clearly but he does not reduce clear thought to the tricks of logic or the capacity to detect inconsistency in an argument. What is essential for critical thought is grounded knowledge. The lack of extensive knowledge of a particular subject will for McPeck preclude the possibility of an individual developing or utilizing critical thought in reference to that subject. In a statement which, taken at face value, would sound the death knell for many critical thinking courses presently offered in faculties of education, McPeck argues that in reflecting and then making decisions about

> real public questions it is usually not the logical validity of an argument that we find difficult but rather the task of determining whether certain premises are in fact true. (p. 25)

McPeck goes on to show through a series of simple yet forceful examples how the presence or absence of concrete specific knowledge of a subject is most often the impediment to the realization of a solution. This is not to suggest that logic is irrelevant to the numerous problems that we encounter both inside and outside the educational process. Most often, however, it is not the logical status of the argument or set of propositions that represents the major problem for us; it is, rather, determining the truthfulness or validity of the evidence that is offered. The only means for resolving this dilemma is to be very knowledgeable about the subject under consideration. For McPeck, an individual could be very, very logical in reference to a particular problem or statement but, if that individual were lacking in knowledge of the subject out of which the problem or statement arises, then the possibility of critical thought being expressed is either slim or nonexistent. McPeck shows that critical thinking is much more rightfully the province of subject matter specialists than of those who are well trained in the use of logic or logical analysis.

McPeck has performed a very real service in showing how many philosophers and educators have misunderstood the concept of critical thinking. The only apparent shortcoming of McPeck's book is that it offers no specific or even tentative ideas for how the school system or educators might realize the conditions necessary for the exercise of critical thinking. McPeck is silent on the issue of how a system or individual teacher can bring students to mastery of subject matter so that they can begin to demonstrate critical thinking abilities. That, of course, is a very large complex issue which McPeck, perhaps wisely, avoids. It would have

been useful to have a man of his intelligence and insight try the more basic problem in the quest for critical thought. Regardless, McPeck's clarification of the term, critical thinking, represents an impressive and notable achievement.

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